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Contents

PAGE

Editorials:
Lake Superior Iron Ore..... 1161
The Copper Statistics for November 1161
The Decline of Spelter..... 1161
Mr. Vanderlip's Views..... 1162
The Steel Corporation Position... 1162
Some Elements in Mine Valuation 1162
Electric Power from Anthracite Waste 1162
Correspondence and Discussion: Cooperation in Research Work .... Shaft Protection .... *The Hommel Furnace for Volatilizing Zinc 1163
Goldfield Consolidated 1165
Tomboy Co.'s New Mine..... 1165
New Works of the Arizona Copper Company 1166
Mining in Porto Rico...W. F. Link 1166
Details of Practical Mining: *Electrical Tank Signal .... Sliding Concrete Mixtures down Troughs....*A Tram Car and Skip....Nonacid Flotation Process....*A Slime Filter Frame ....*Dumping Skip for Winze ....*Air Hammer Drilling in Sticky Ground....*Pump Fishing Device....*Wrench for Removing Stuck Drills....Staging for High Set-ups in Stopes.... A Drill for Soft Ground....*A Method of Cleaning Waste.... *Fastening Pipe to Shaft Stulls 1167
Col. Edward D. Meier..... 1171
Zinc Mining at Galena, Kan., A. L. Morford 1171
Minerals Separation Co. Sues..... 1172
New Equipment at Negaunee Mine, Michigan.....P. B. McDonald 1172
Chlorination Abandoned at Colorado City 1172
*Sampling Errors Due to Copper Bar Shapes...Donald M. Liddell 1173
Zinc Dust 1173
*A Dry Land Dredging Machine. Lewis H. Eddy 1174
Electric Hoists for Mines. D. B. Rushmore 1177
*The Estimation of Ore Reserves. Frank H. Probert and Roy B. Earling 1179
The Permian Copper Ores in Texas. William B. Phillips 1181
*Concrete Methods at Salmon River Dam 1182
Notes on Mining at Tonopah. Claude T. Rice 1184
*The Braden Copper Company—II. Pope Yeatman 1186
The Manufacture of Lithopone..... 1189
*Hematite in Veins of Globe District.....John Saunders 1191
New Publications 1193
Personal, Obituary and Societies... 1194
Editorial Correspondence 1195
Mining News 1197
Markets 1203
*Illustrated.

The Engineering and Mining Journal

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Lake Superior Iron Ore

The Lake navigation season has closed, with a total shipment of iron by water of 32,130,000 tons; which is less by 10,491,000 tons, or about one-fourth, than the total for the season of 1910. The real decrease is somewhat less than that, since December of last year found the lower Lake docks with a large surplus of ore in storage, while the blast furnaces were, as a rule, carrying considerable stocks in their yards. A large part of this surplus has been used; the exact quantity it is impossible to ascertain. It is quite probable that the actual consumption of Lake ore this year will show a decrease of between 5,000,000 and 6,000,000 tons from 1910. This is quite a formidable quantity, it is true, but less than the shipments alone would indicate.

Taking the shipments by ports, we find that the decrease from the Old Ranges—the Marquette, the Menominee and the Gogebic—was about one-fourth, or the same as the general average. From the Mesabi, however, there were some notable changes. The shipments from Duluth fell off about one-half, but on the other hand, those from Superior increased by about one-sixth. This gain, in the face of the large losses elsewhere, is evidence that the Steel Corporation has been working its new mines on the Hill leases up to their capacity, in order to approach as nearly as possible the minimum on which it must pay royalty and freight; while producing from its older Mesabi mines only the minimum tonnage. This was the obvious business course, if the Corporation was to get any return from the onerous payments which it has to make on the Hill lands.

In view of the recent activities in the iron market, there has been some talk of a scarcity of Lake ore before navigation opens in the spring. Such a contingency is hardly likely, in view of this year's diminished production of pig iron. The worst that can happen, if the improvement continues, is that ore docks will be lightly stocked next May, and early shipments will be in order. This year nothing was done before June.

The Copper Statistics for November

The reduction of 23,212,454 lb. in the American stocks and of 12,544,000 lb. in the European visible supply that occurred in November, a total of 35,756,454 lb. was surprisingly large. The grand total now stands at 276,066,788 lb., of which 19,376,000 lb. is copper afloat (exclusive of that which is afloat from America and does not figure in any statistics). The American stock of electrolytic copper is now well under 100,000,000 lb., and not very much in excess of what the refiners must always carry as a working stock.

The huge reduction in the American accumulation in November was partly due to the increase in deliveries and partly to the diminished production. The latter was due probably to accidental causes, including delay in the arrival of crude copper from the West. Of course the increased production of the smelters implies an increase in the refiners' statistics before long. In the meanwhile consumption may also increase. We shall have more light upon the situation right after the end of the year when fuller statistics will become available.

The Decline in Spelter

The spelter market, which had been soaring to extraordinary heights under peculiar conditions, experienced a sudden decline on Dec. 7. Since then there has been something like demoralization in the business. A market that had previously been considered sold out suddenly was treated to liberal offers, not only for the more distant but also for near-by deliveries. This was simply another illustration of what has often been demonstrated, namely, that smelters who had been considered unable to supply anything were found to be able to scrape up at least moderate quantities when their

interests showed it to be advisable to do so.

We do not think that there was any manipulation in the recent advance in spelter. The smelters who convert the major part of their product into sheet zinc advanced the price of the latter by ¼c. per lb. on Nov. 24, and reduced it by the same amount on Dec. 11. These smelters are not subject to speculative influences and are guided mainly by their interpretation of the general trend of things.

We said, in no unmistakable terms, in these pages on Nov. 18, that the situation in spelter was unsound and repeated our warning on Dec. 2. The collapse of the last week resulted from the intrinsic unsoundness of the situation, to which we had previously drawn attention.

Mr. Vanderlip's Views

In an interview published last week the president of the National City Bank made the extraordinarily sweeping statement that "it is pretty generally agreed that business has ahead the most serious situation that has existed since you or I have been observers," barring the doubts and uncertainties of 1896. Mr. Vanderlip had previously admitted that, judged by the ordinary tests, there is nothing very serious with business, its volume being large, also the consumptive demand, while no longer is there either overproduction or undue expansion and the banking and credit position is sound. Having been assured as to those essential points, the eye leaped through Mr. Vanderlip's lines in haste to arrive at the dreadful, mysterious thing that he was about to disclose. It turned out to be merely the Sherman law. Verily, the mountain labored and produced a mouse.

Mr. Vanderlip is manifestly wrong about the "pretty general" agreement that he assumes and probably is wrong about his understanding of the Sherman law. If the latter were directed against industrial economy there would indeed be ground for foreboding, but that does not seem to be the case, its aim apparently having been to restrain commercial malpractice, which purpose is good. The recent alarm has been over perverted ideas of the officers charged with the enforcement of the law, rather than over the law itself, and there is reason to believe that they have lately enjoyed more light. Neither the oil nor the tobacco company, both convicted malefactors, has found it difficult to reorganize to the satisfaction of the Federal courts.

Mr. Vanderlip has an extraordinary prestige both from his position and from his forecasting in 1907 of the panic of that year. The panic of 1907, resulting from the over-strain on capital, was of world-wide extent, sweeping over Egypt, Japan, Chile and Germany, and finally breaking out in the United States. Recent adverse conditions have been of a different order. In the United States they have been largely sentimental. If Mr. Vanderlip had published his interview three months ago he would have produced genuine alarm, but people have now regained their senses and are inclined to regard such unsupported pessimistic assertions as unbecoming, and perhaps merely peevish.

The Steel Corporation Position

The announcement of the United States Steel Corporation that its unfilled orders at the end of November amounted to 4,141,955 tons means that there was an increase—an excess of bookings over shipments—of 447,627 tons during November, compared with an increase of 83,011 tons in October and a decrease of 84,668 tons in September. The November showing was far beyond the expectations of the trade, a fact which will readily be appreciated when it is observed that the corporation's full capacity, even in a short month containing a holiday, is not under about 1,100,000 tons, so that the 447,627 tons excess of bookings over shipments represents 40 per cent. of the capacity; if shipments amounted to 75 per cent. of capacity, as will be generally credited, bookings exceeded full capacity by about 15 per cent. Not since the closing months of 1909 has there been any indication that in a single month the bookings were equal to capacity.

It has always been recognized that the corporation could not show unfilled tonnage on books running into several millions of tons even in dull times without including much contract and other business not for immediate rolling, and a large part of the November gain no doubt lay in this class, but the showing is impressive nevertheless.

Some Elements in Mine Valuation

The projected amalgamation of the four porphyry mines of the Miami district is developing the usual calculations in which the financial press is wont to indulge. Given pen, ink and paper, it is a simple matter to figure mining values. The accuracy of the figuring is another story.

The tonnage of the ore developed, the average yield of the ore and the number of shares issued fall far short of comprising the elements of calculation. Assuming that the data of ore development has been satisfactorily determined, other factors in valuation are chances of finding more ore, system of mining capable of employment, proportion of ore extractable, capital required for equipment, and time to elapse before dividends may reasonably be expected.

The last factor is generally overlooked in the valuation of the stocks of new mines; at least it is overlooked by investors. If a stock is figured out to be worth $10 and cannot reasonably be expected to pay dividends inside of three years, its present value is not $10, but is that sum less interest. The Miami companies fortunately have the services of excellent engineers.

Electric Power From Anthracite Waste

The utilization of small anthracite and culm, now generally regarded as waste, has often been discussed. Among the plans suggested has been the conversion of coal at the mines into gas, or into electric power, and its transmission to other points. The Lehigh Coal & Navigation Co. has adopted the latter plan and is beginning the construction of the first unit of a great electric-power plant near its mines. This unit will begin by furnishing power to the company's own mines, but will be gradually enlarged, the company's plan being to sell power to outside enterprises within the transmission radius, as its plant is developed to the projected size. That the company has adopted this plan and will put it into practical operation is doubtless partly due to the fact that it is the only important anthracite company which draws its profits from the mining of coal and not from its transportation.

Correspondence and Discussion

Co-operation in Research Work

In reply to a note on coöperation between the industrialist and the scientist, in the JOURNAL of May 20, 1911, I should like, first of all, to call the attention of "B. F." to the fact that this move is no longer in the experimental stage. Within the last year, at the University of Pittsburgh, not only has there been organized the department of industrial research, under the direction of Prof. Robert Kennedy Duncan, and a new building built to be entirely devoted to this work, but there are already 22 men engaged in the research work—and $40,000 in salaries alone will be spent during the next year, by industrialists, who wish problems of widely varying nature investigated and who recognize the rare opportunity here offered them. It is not necessary to go into things which are assured for the future nor to reiterate the successes of the men who have worked under a similar arrangement at the University of Kansas, to show that that which "B. F." terms an "eleemosynary institution" is far from being a charity. If, however, it is to be so called, I should dislike very much to be asked to state which side the charity is on.

My plea has been, simply that this move be taken up by some of the mining schools in the western part of the United States, where, because of the rareness of well equipped commercial laboratories, it would appear that there was much more need of such coöperation.

In reply to the statement of "B. F." that he fails "to see what advantage would come to the practical engineer from college research work," I can do no better than to call attention to some work done by college professors, which even, he, though not himself a scientist, must admit is of use to the practical engineer. For instance, the work of Nernst on electric lighting; Richards, along various metallurgical lines; Van Hise, in geology; Burgess, in the preparation and study of pure iron and its alloys; Cottrell, on the electrical precipitation of water from petroleum and of smeltery fumes.

As regards the manufacturers' ability and willingness to purchase needed pieces of apparatus, the old saying: "A bird in the hand is worth two in the bush," in in no place more applicable than to apparatus required for immediate use on some item of research—and this need cannot always be foretold. What could be more disconcerting and delay a research further than to have to wait a month or so for a piece of apparatus which may be needed for only a comparatively short time! The scientific man has at his disposal innumerable pieces of apparatus not to be found in the ordinary industrial laboratory—and such occasion for hindrance is not so frequent an occurrence. The same proverb holds true in regard to one's associates. With the scientific man they are ever present and easy to find, with the requisite time to give their aid. In the case of the practical engineer, where are his associates when most needed? In China, Peru, Alaska, or where not?

There is no generality as concerns the specific problems undertaken for each individual concern. The problems are concerned with bread, with glue, with petroleum and with the smoke nuisance and every possible perplexity in which the knowledge of the scientist can be of assistance in unraveling. The system of industrial fellowships takes care of the fellows from the standpoint of remuneration, as well, if not better than some industrial engineers are able to provide for themselves. Bonuses of various kinds and sizes are offered for the successful solution of problems in hand.

This purely monetary consideration of the engineers is, with the research men, combined with the additional and higher incentive of congeniality of college surroundings pervaded with the research work. In very truth the sphere of the engineering school is educational. But will it not be more so the better the student is fitted for his life work? Is not a young engineer's lack of ability to plan for the solution of the new phases of a problem the most marked of his failings? How can this be remedied if he does not have for instructors men who are able to attack and successfully solve problems of the same nature as those which are to be met by him in his engineering practice?

The attitude of competition is nonexistent. In all cases the relations of research men with practical engineers are meant to be coöperative, a friendly aid in the bringing about of economical solutions of the worrisome problems of the industrialist.

RAYMOND C. BENNER.

Pittsburg, Penn., Dec. 4, 1911.

Views, Suggestions and Experiences of Readers

Shaft Protection

Shaft sinking is one of the most costly operations in connection with underground mining. Because of this and the fact that a working shaft is the avenue of traffic through which the mine's output must find its way to a market, the proper selection of a shaft site, and the protection of the shaft itself, should receive careful consideration. It is unfortunate that such is not always the case. That most of the large and all of the well managed companies realize the importance of the proper sites for a main working shaft is apparent from the careful preliminary work that is done, including the careful outlining of the orebody, by drilling or otherwise.

The question of the protection of a shaft, once sunk and in operation, is one that is still open, although it is certain that much more care regarding this important feature is observed now than in the past. A working shaft is usually intended for use over a certain period of years, dependent upon the size of the orebody and the output, and this—the life of the mine—is predetermined, as far as possible, although the annual output is dependent largely on the market for the product, and perhaps to a lesser degree, on the capacity of the refining departments. Under such circumstances it is disconcerting to the owners and embarrassing, to say the least, to the management to find that at a time far short of the estimated life, it is necessary either to sink a new shaft or to make extensive repairs to the old one; especially so, if it is found that the defects would not have occurred if greater care had been exercised in the protection of the shaft.

A shaft may fail in several ways, but a most prevalent one is that of caving, and in the earlier days of the industry there is little question that this was due largely to a system of mining whereby stoping was permitted to encroach upon the shaft. In many cases this was traceable to the desire of the mining "captain" to remove as much ore as possible. In the case of an inclined shaft sunk in the vein, or that of a vertical shaft when it is in the ore zone, too much emphasis cannot be laid on the matter of leaving an ample shaft pillar. In a certain district, well known for its present high standard of mining practice, the ignorance or carelessness of early operators —those of 25 years ago, or more—is now becoming apparent in the almost continual caving going on in the inclined shafts, in the vicinity of the upper levels, and the constant shifting taking place in the vertical shafts, resulting in throwing

the latter, in some cases, out of alignment to such an extent that before repairs are made it is necessary to reduce hoisting speed materially at the affected point. One mine worked through inclined shafts, was forced to cease all operations, the shafts having closed up completely. In this same district the problem of the inclined shaft has been solved best by sinking in the footwall at a short distance horizontally from the vein, thus removing forever the danger of caving. The matter of shaft pillars is one that has a direct bearing on the ability of a mine to continue profitable operations and warrants close and constant surveillance.

New York, Dec. 4, 1911. L. E. I.

The Hommel Furnace for Volatilizing Zinc

In the JOURNAL of Sept. 23, 1911, a process for the manufacture of zinc oxide is described under the heading, "The Blum Zinc Oxide Process." The use of a Huntington-Heberlein pot for volatilizing zinc from its ores is claimed as a novelty, and the use of alternate layers of coal and mixed charge as a special advantage. To my knowledge the applicability of a Huntington-Heberlein pot for this purpose is a long known fact. Messrs. Huntington and Heberlein were themselves the first ones to realize this and to take out a patent accordingly.

COMPARISON OF ZINC OXIDE PROCESSES

The article, in describing the claims of the Blum patent, further states that the depth of the charge employed in a Huntington-Heberlein converter, when zinc residues are blown, necessitates a blast of high pressure, which produces furnace conditions resulting in the reduction of the iron oxide contained in the ore. The reoxidized iron is said to contaminate the zinc oxide and to turn it yellow. For the Blum process it is claimed that it does not suffer from this disadvantage.

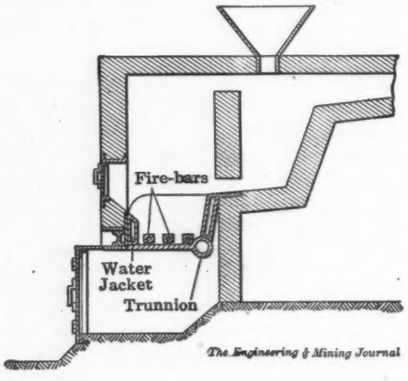
It is not easily understood why this should be the case, if one bears in mind that the reduction temperature of zinc oxide lies in the neighborhood of 1000 deg. C., whereas iron is reduced below 700 deg. This makes it obvious that the iron must always be reduced long before the zinc oxide, whatever the range of the blast pressure may be. Nor can it be accepted as an argument that the zinc oxide obtained from zinc residues has (partly!) a yellow tint, whereas the oxide produced by the Blum process is said to be quite white.

Such a comparison is entirely out of place. Zinc residues are exceedingly impure, containing large quantities of metallic iron in finely divided condition, which to a large extent will be blown out of the charge mechanically, being oxidized while passing into the dust bags. On the other hand, the ores, from which the white oxide of the Blum process was obtained, were relatively rich in zinc, were employed in lumps and contained the iron as massive oxide.

CAUSES OF VARIATIONS IN PRODUCTS

I know from many years' practical experience that the quality of the zinc oxide obtained by means of a Huntington-Heberlein pot varies according to the ore or material treated and I have found that in many cases the yellow tint of the oxide is not at all due to iron, but to small quantities of lead.

The fluidity of the slag formed during the blowing operation is also entirely and solely dependent upon the character and constituents of the ore treated. In some cases a "highly liquid slag" is formed, in others a "fairly porous cinder." This statement must be true, whatever process may be used, as long as one endeavors to obtain the volatilization of the zinc, because for this purpose a temperature of at least 1000 deg.



VERTICAL SECTION OF HOMMEL FURNACE

C. is essential, which is sufficient to smelt a slag of almost any combination.

The article also states that in a Huntington-Heberlein converter no more than 400 kg. of ore can be treated. This statement is misleading, because a Huntington-Heberlein converter is not an apparatus of constant dimensions, but can be constructed according to demands. Whereas the earlier, conical-shaped types contained about one ton of charge, the later ones, which are bowl shaped, were constructed to treat 20 tons and more at a time.

One serious disadvantage, from which all such operations suffer when performed in a converter covered with an iron hood, is, that the enormous heat, developed on the surface of the charge by the burning zinc fumes and the carbon monoxide, destroys the hood in an exceedingly short time. A further point for consideration for an economical working is the following: The best results are obtained with a charge from 30 to 40 cm. high. However, the lower the charge the larger must be the diameter of the converter if a reasonably big unit is desired, and this means so much more initial fuel to ignite the charge, a point of great importance in districts where coal is expensive.

FEATURES OF HOMMEL FURNACE

These facts have induced me to abandon the ordinary Huntington-Heberlein pot for such operations altogether and to perform same in a specially constructed furnace.[1] This furnace may be best characterized as being a combination of a rectangular pot or converter with a furnace chamber. The rectangular shape of the converter has the advantage that its sides may be provided with water jackets and that instead of a perforated bottom, which soon buckles and burns out, a grate of hollow firebars may be used. The air is introduced through the hollow trunnions and firebars, whereby they are kept cool. Behind the converter is a vertical wall or partition of refractory material, which extends across the furnace chamber but leaves free passages both at the top and the bottom. This partition practically divides the furnace into two chambers. At the top of the furnace and to the rear of the partition is a hopper, arranged to feed the mixture of coal and material to be treated, into the rear chamber. The floor of this chamber slopes toward the blowing hearth and constitutes a kind of ore bin.

While the blowing operation is proceeding the bulk of the escaping gases pass through the upper passage above the partition to the flue, but some of the hot gases may also pass through the lower passage, that is, through the mass of material which is being fed in. By these means the fresh material is thoroughly heated before it reaches the hearth. The advantages of this arrangement are the following: No initial fuel for the ignition of each charge is necessary, because after the converter is emptied the next charge arrives ignited and red hot in the same.

The whole operation is, therefore, greatly shortened (requiring not more than two hours, including charging and emptying, and the capacity of the furnace is consequently about three times larger than the capacity of an ordinary converter of the same size.

The working costs are low. No great excess of carbon is necessary, since the heat given off by the process is utilized for thoroughly heating up the next charge and the reaction starts immediately after the same has been placed in the converter. The waste heat may be easily utilized to heat a boiler and to produce all the power required for the blowing operation.

W. HOMMEL.

London, Nov. 13, 1911.

[1] U. S. pat. 932,279; Brit. pats. 27,018, 1907, and 10,667, 1908.

Goldfield Consolidated

While in the East recently, George Wingfield, president of the Goldfield Consolidated Mines Company, was quoted as saying: "I will not go on record now or in my annual report as to how long I think Goldfield can continue to pay 50c. quarterly dividends. The fact remains, we have just declared that amount payable Jan. 31; beyond that I can say nothing. Goldfield has in its treasury upward of $2,000,000, which is as much as it ever had at this time. Stockholders will be given a good idea of ore reserves in the report, but in all fairness to them, I cannot anticipate that statement."

Mr. Wingfield refused to make any prediction as to the possibility of reducing mining costs below those shown in the last monthly report, about $6.40 per ton, but stated that through the installation of some new cyanide tubes, it is now possible to treat a lower-grade ore than formerly, and added that all low-grade material that would show a profit had been put through the mill.

The Grizzly Bear shaft will be sunk to a depth of about 1400 ft. Recently from the 1200-ft. level of this shaft a connection was made with the lower workings of the Clermont shaft, chiefly for ventilation. On the question of ore reserves, Mr. Wingfield said that no more than 10 per cent. of the ore below a depth of 750 ft. had been extracted. As to the reason for the recent fluctuation in monthly profits, Mr. Wingfield said: "That has no special significance. Last month's production dropped more than $400,000 from the previous month, but it was due entirely to circumstances. No effort has been made to maintain a certain average production and no effort will be made in the future to that end. The company's financial position speaks for itself."

Tomboy Co's New Mine

DENVER CORRESPONDENCE

The Revenue Tunnel Co., of which A. E. Reynolds, of Denver, was the largest owner, has recently sold the Montana mine, near Ouray, Colo., to the Tomboy company, for $400,000. The Revenue tunnel, 7800 ft. in length, starts in Sneffels Basin and was driven to develop at great depth the Virginius vein, which, in the early days, was worked from the surface at an elevation of 13,000 ft. The tunnel goes through the mountain range, which divides the waters of the Uncompahgre and San Miguel Rivers, and passes from the Ouray side to the San Miguel; in its course on the Virginius vein it taps the Montana vein, which crosses the former at an oblique angle.

The Montana vein is an extension of the Red Cloud, Argentine and Cincinnati claims on the Savage fork of the San Miguel River, and is in what is known as Savage Basin at an elevation of about 11,200 ft., from which properties the Tomboy company, owning them, has extracted 1,055,807 tons of ore, yielding bullion worth $9,321,408 in 10 years. The Montana ore had to be transported a long distance through the Revenue tunnel to the mill at its portal, and this was a great disadvantage. It is estimated that the Montana has ready for extraction ore worth an amount equal to the purchase price, the estimated average grade being $9.25 per ton. This ore will be conveyed through the Ophir tunnel, which intersects the Montana vein, and from its portal by a surface tram to the 60-stamp mill of the Tomboy company. The Ophir vein is said to be a western extension of the Camp Bird vein and the Camp Bird company had an option on the Montana at one time, but failed to exercise it. As both the Montana and the Tomboy have large amounts of virgin territory, the company will probably be a large producer of gold ore for many years.

Power Troubles on the Rand

JOHANNESBURG CORRESPONDENCE

There is something seriously wrong with the huge generating stations and equipment of the Victoria Falls & Transvaal Power Co. Frequent interruptions have occurred in the supply of power, and the company has rendered itself liable to heavy penalties owing to failure of current and consequent stoppage of mills and winding plants. Now several mines have been notified that current cannot be supplied, and they are starting up their own boiler plants.

Some mines, like the Cinderella and Brakpan, have no boiler plants; others, like the New Goch, have scrapped their boilers. A total cessation of supply is not expected, however, and these mines will no doubt be supplied. The City Deep mine has started up a steam plant for its mill, which is one of the latest and designed solely for electrical work.

The power company was registered in October, 1906, to take power from Victoria Falls, but operations were soon transferred to the Rand. The electrical plant at Brakpan belonging to the Rand Central Electric Co. was acquired and enlarged. Other stations were built at Simmer Pan, Rocheiville and Robinson Central Deep, and another station is contemplated at Vereeniging, 90 miles distant. The original capital was £3,000,000, and in April, 1909, an amalgamation took place with the Rand Mines Power Supply Co. Nearly all the plant was furnished by a German company, which is a large shareholder, and much German capital is interested.

The cause of failure and interruption of current is supposed to be due to the fact that the current at 40,000 volts is carried on overhead lines. In the spring and summer the Rand is noted for its electrical disturbances, and no systems of arresters or protection seems to have proved adequate in avoiding damage and accident. There are large electrical-supply stations at Randfontein, Kleinfontein and East Rand, which have been working well for several years, but in all these the main transmission lines are carried underground.

The chairman of the power company, the Marquis of Winchester, is out to investigate the trouble; one of the directors of the Rand mines is on his way here. Needless to say, the delay and expense that will be involved in re-laying about 40 miles of cable will be enormous. It seems, however, that the trouble is not wholly due to the above mentioned cause, as interruptions were frequent even during the dry season. There may be some more serious and deep-seated trouble with the plant. With penalties for non-supply, the outlook is not bright for the shareholders, and the mines can scarcely bear any addition to their costs.

The Rand, the home of the best technical skill money could procure, has not furnished a brilliant record lately. The City Deep mill has proved a terrible failure. The Randfontein Central has failed to supply its 600-stamp mill with ore. The East Rand Proprietary mines have probably been over-valued and mismanaged; relief from an impossible situation was only found by informing the public that £50,000 worth of gold had been let go to waste out of two or three separate cyanide plants without anyone knowing anything about it. This amazing statement is now being investigated by a government commission, and the report will be eagerly awaited.

Cambria Steel Co. to Try Briquetting

At present, when there is so much interest and discussion as to the method of treating flue dust and iron ores, that they may be converted into the best physical and chemical condition for future use in blast-furnace operations, it is interesting to note that the Cambria Steel Co. has about completed the installation of an experimental plant in which it is going to apply the Schumacher & Ronay briquetting processes. These processes are in successful operation in Germany, Belgium, Russia, etc., where over a million tons are now annually briquetted. The General Briquetting Co., 25 Broad St., New York, is the owner of the American rights.

The mill which was built at Georgetown, Colo., to try out the Malm dry-chlorination process on a commercial scale, has not yet been placed in operation.

New Works of the Arizona Copper Company

At the last annual meeting of the Arizona Copper Co., Ltd., in February, it was stated that a committee of directors was proceeding to Clifton, Ariz., to consider the site for a new reduction works. At the same time it was stated that Dr. L. D. Ricketts had been appointed consulting engineer. The new works were necessitated by the large bodies of low-grade ore, which could only be made available by a modern plant. The directors of the company indicated the sites suitable, in their opinion, for the new plant, as did also James Colquhoun, manager, and the matter was turned over to Doctor Ricketts for settlement.

He has selected a site near the present line of the Arizona & New Mexico Ry., near Clifton, for the smelting plant. The concentration will be performed in the company's No. 6 mill, at Morenci, and No. 3 and No. 4, at Clifton, will be abandoned. The reconstruction of these mills, and their replacement were considered, but neither of these courses was considered advisable.

No Blast Furnace at First

The ores and other materials to be smelted have been divided by Doctor Ricketts into three classes, two of which will be treated in reverberatory furnaces, and the third in converters. The erection of a blast furnace is not contemplated at present, but provision will be made in the plans so that one can be erected as an integral portion of the works, if necessary. With the new works in operation it is thought that much ore will then be payable, which now cannot be profitably treated.

A central power station at the new works is recommended, at which it is believed that 50% more power could be generated at 50% of the present costs. Waste-heat boilers on the new reverberatories will furnish all the power required at the smeltery, and in addition a large portion of the steam requirements of the mines and concentrator.

Ore Reserves

Before deciding on the new installation the question of ore reserves was most carefully investigated. Doctor Ricketts reported that the company might safely figure on an ultimate recovery of 400,000,000 lb. of copper, with great possibilities of a still further recovery. The expense of the new reduction works is recommended on the ground that the mines justify it many times over, and that the present low price of copper demands improvements in the present practice. No great expansion is recommended, and the conservation of the reserves carrying over 3% of copper in the Humboldt and Clay mines is recommended, the leaner bodies to be drawn on to keep up the production.

Under the new conditions it is purposed to treat about 1,000,000 tons of ore of all classes per annum, and to produce about 43,500,000 lb. of copper per annum. To do this the outlet from the Coronado mine must be improved, so as to give easy transportation to mill No. 6, at Morenci. This work is now being proceeded with.

To finance the new works, an outlay of about £450,000 to £500,000 is required. New 10-year 5% debentures, redeemable at £103, to the amount of £500,000, are to be issued. The existing debentures, £175,210, payable 1912, will be paid off, the holders to be given the right to subscribe to the new issue to the amount of their present holdings. The benefits to be derived will be the treatment of lower-grade ores with a higher recovery, thus extending the life of the mines; a lower cost per pound of copper produced, estimated at 2c. per lb. under existing costs; and an annual production of 43,500,000 lb., or about 5000 tons above the present output.

Geologic Map of North America

A large geologic map of North America has just been issued by the U. S. Geological Survey. It is printed on four sheets, which, fitted together, make a map 6 ft. 5 in. high by 5 ft. wide, the largest piece of work ever issued by the Survey. The scale is 1:5,000,000, or 80 miles to the inch. There are 42 color distinctions, representing as many divisions of rock strata.

When used as a wall map, the regions illustrating different types of geology, stand out boldly, but the smaller divisions are not distinguishable at a distance; viewed close at hand these minor distinctions can be read and the map can be used for detailed study, limited only by the scale.

The map embodies all the available published data and unpublished manuscript maps in the offices of the Survey. The map may be obtained at a nominal price of 75c. by addressing the director of the U. S. Geological Survey, at Washington.

Indian Blast Furnace Blown In

A cablegram has been received announcing the blowing in on Dec. 1, 1911, of one of the Tata Iron & Steel Company's two new blast furnaces at Sakchi, Bengal, about 150 miles from Calcutta. Axel Sahlin, of Kennedy, Sahlin & Co., Brussels, Belgium, construction engineers, was present at the blowing in. Julian Kennedy, of Pittsburgh, is now on his way to Sakchi. The open-hearth steel plant, consisting of four 40-ton furnaces, will probably not be started up until spring.

Mining in Porto Rico

By W. F. Link*

It has been known for a long time that mineral veins exist in the mountainous regions of Porto Rico, but not enough prospecting has been done to prove the veins in any district. The Porto Rican has no confidence in himself as a miner, nor does he regard mining as a business. Therefore, no mining of a serious character has been started until recently, and no real development work done on a large scale.

Prospects Found near Guayama

Mining has been started by Messrs. Nelson and Link in the center of a mineral belt that they discovered about 10 months ago. This territory lies on the slope of a creek valley in the small borough of Carmen, near Guayama, about eight miles from the sea coast. The conditions in this camp are excellent, timber, water and labor being plentiful. On the left side of the creek valley there are a number of parallel veins which have been opened at intervals of from 50 to 300 ft. The outcrops of these veins have been traced for several miles, the float showing ore assaying about $32 per ton, with free visible gold.

ANALYSES OF SORTED PORTO RICO ORES

	First-class Lead Ore	Second-class Lead Ore	Gold Ore
Au, oz. per ton	0.52	1.56	4.03
Ag, oz. per ton	24.64	5.44	18.77
Cu, %	1.30	1.60	0.20
Pb, %	52.50	25.20	18.88
SiO_2, %	9.80	42.00	
Fe, %	9.80	12.20	
CaO, %	2.50	3.50	
S, %	2.40	1.50	

Gold-silver-lead Ore Shipped

The exploration of several veins is already in progress on four different lodes. On one vein a main shaft and two winzes are being sunk to 70 ft., while a tunnel, being driven for 50 ft. into the low hill, has cut two veins with opposite dips. From this place three small shipments of galena ore, free from zinc and easily fluxed, were sent to the Balbach smeltery, in New Jersey. Typical assays of this ore are given in the accompanying table.

At another place, on the left side of the creek valley, three veins have also been explored by driving tunnels and drifts as far as 100 ft. and sinking a shaft to 120 ft. The width of the veins varies from 1 to 12 ft. and the streak of high-grade gold-silver-lead ore measures from two to eight inches in width. A 10-ton shipment brought $550 smeltery returns. In these workings the veins are showing ore throughout as the drifts are being extended.

*Salinas, Porto Rico.

Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

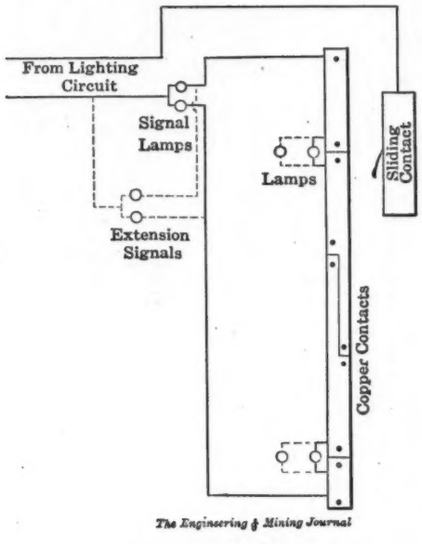
Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Electrical Tank Signal

By Chester Steinem*

The accompanying sketch shows the electrical connections for indicating the depth of solution in a tank, by means of two signal lamps, situated where desired. The device was introduced at the Socorro mill by D. J. Kennelly.

The sliding contact is attached to a float in the tank by a cord over a pulley (not shown). If a four-strand block is used, the distance traveled by the sliding contact will be shortened enough to permit housing the whole. The dotted lines show an extra set of signals in case two places are to be provided with them. Here the contacts are so dimensioned that when the upper lamp burns at full candle power, the depth of solution is 15 to 15½ ft.; at half power, 13 to 15 ft. When both lamps burn at half power, the depth is 11 to 13 ft.; when the lower lamp burns at half power, 9 to 11 ft., and when the lower lamp burns full, the depth is 7 to 9 ft.; no light shows for depths less than seven feet.



Wiring for Tank Indicator

*Mogollon, N. M.

Sliding Concrete Mixtures down Troughs

In doing the concrete work at the Wolverine and Mohawk mines, W. F. Hartman, engineer for both properties, effected a considerable saving by sliding the concrete from the mixer to the forms down troughs. These troughs were made of sheet iron bent to a diameter of 24 in., although sheets 18 in. wide could have been used. When this was first tried it was feared that there might be a separation of the concrete while sliding down the chutes, but by using brake boards, somewhat like the fingers used in finger chutes to retard the flow of the mixture, separation was prevented. The concrete piled up at each board, and when enough had accumulated to force its way past it did not go far before it encountered another. In this way the rubble was most thoroughly coated with cement.

It is no uncommon thing to slide the concrete down 200 ft. at this mine where the troughs have the same dip as the lode, approximately 38 deg., and in one instance concrete was shot down 500 ft. At the first drop it slid 200 ft., then was reshoveled from a platform to the second line of chutes, 100 ft. long, and then by reshoveling after each of two more 100-ft. drops it reached the plat at the forms. There, as is usual in this concrete work where the mixture is shot down chutes, the concrete was turned over once before being shoveled into the forms.

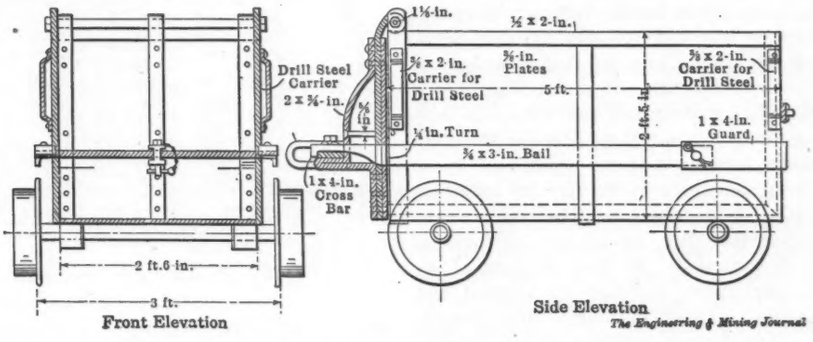
The retarding board is nothing more than a 2x12-in. plank with a cross piece nailed to its upper end, by which it is fastened in the trough by a rope or wire going around the body of the chute. At the lower end of the plank old sacks are tied, which block the passage of the mixture until the weight of the accumulation is sufficient to force the board upward, permitting a portion of the mixture to pass under the end of the plank.

A Tram Car and Skip

By Guy C. Stoltz*

At the Forest of Dean mine in Orange County, N. Y., the ordinary two-ton tram car is remodeled as shown in the accompanying sketch and fulfils the twofold purpose of tram car and skip. The cars are loaded on the level tracks at the foot of the incline and are pushed to the incline where the cable, with clevis attached, is made fast to the cross arm of the bail which presses against a ¾x2-in. piece of iron attached to the door as shown. The cars are then drawn up the 2300-ft. incline to the headframe where they are dumped by having the bail continue on a 45-deg. angle while the car wheels run on level auxiliary rails. This enables the cross arm to rise considerably over the end of the car and permits the rolling ore to open the door.

The emptied car is then lowered to the working level, the pin is removed from the clevis and the clevis and rope attached to a loaded car while the empty is pushed back to the stope to be re-



Combined Tram Car and Skip for Inclines

*Mining engineer, Mineville, N. Y.

filled. Drill-steel carriers are made by riveting ⅜x2-in. flat iron to the sides of the car and since the incline is free from vertical curves, steel is brought to the surface or lowered to the mine in a satisfactory manner.

Non-acid Flotation Process

A new flotation process, based on the use of water containing 0.01 per cent. of an aromatic hydroxyl compound, such as phenol or cresol, is described in Brit. pat. No. 18,943 of Aug. 11, 1910. A mixture of one part of finely powdered ore to three or four of water containing one or both of the above substances, is agitated with air, so as to form a froth, which contains the metallic sulphides substantially free from gangue. If metallic copper be present, it will also separate with the sulphides. The addition of a small quantity of alkali facilitates the process. No acid whatever is added.

A Slime Filter Frame*

In the slime plant of the Talisman mine, Karangahake, N. Z., there are two filters of the fixed-frame type, each set consisting of 31 leaves, each 9 ft. long and 4 ft. 9 in. wide, equal to 2650 sq.ft. of filtering surface. The frames were spaced 7½ in. between centers, but 8 in. is found to be more convenient. They are connected at each end to a 4-in. manifold leading to the vacuum pump.

A gage glass is fitted in the connection to one of these manifolds, so that a defective cloth is readily noticed. Any leaf may be disconnected and removed without interfering with the rest. The details of the frames are shown in Figs. 1 and 2. Black corrugated iron with 1-in. corrugations forms the support for the cloth and is held by a frame formed of ¾-in. piping, having a ½-in. slot cut longitudinally to receive it. The tanks containing the filter frames are 20 ft. long, 10 ft. wide and 7 ft. deep, and are of ⅜-in. steel plate, stiffened by vertical and diagonal braces of angle iron 4x4x⅜ in. The bottom consists of two square pyramidal hoppers 7 ft. deep, formed of ¼-in. steel plate and stiffened with a horizontal rib of 3x3x¼-in. angle iron placed half way down. The filter frames are supported at either end by a 3x3x½ angle iron. The weight of the tank is supported by a 5x5x½-in. angle iron riveted on the side and resting on an 18x7-in. H-girder supported on cast-iron columns. At the ends of the tank similar angle irons rest upon 12x5-in. H-girders, the ends of which are supported by the ends of the 18x7-in. girders.

*Excerpt from an article entitled "Mining and Ore Treatment at the Talisman Mine, Karangahake, N. Z.," by Arthur Jarman; *Proceedings*, Australian Institute of Mining Engineers, September, 1911.

The capacity of the filter tank is a little more than 60 long tons. A full charge comes up to 6 in. from the top of the tank. Agitation is effected by compressed air, admitted from ½-in. pipes, two near the bottom of each hopper. The slime is prevented from impinging on the filters, while the tanks are being filled, by a ⅜-in. baffle plate.

There are two vacuum pumps to work to a net lift of 40 ft. They are wet, double acting, belt driven, and either side of the cylinder can be disconnected. The cylinder is 18 in. diameter by 18 in. stroke, and at 50 r.p.m. a vacuum of 23 to 25 in. of mercury is maintained.

An hour at this vacuum suffices to build up a ¾- to 1¼-in. cake, when the cloths are new, and a 1-in. cake is equivalent to about 10 tons of dry slime. Old cloths work slowly, owing to the formation of scale. During the formation of the cake the solution is pumped to a 15x15x4-ft. settling tank, from which it goes to the weak-solution settler, prior to entering the zinc boxes. The slime remaining in the tank after the cake is formed is pumped out into a storage puddler vat, 22 ft. diameter by 5 ft. deep. Weak wash solution is run in from one of the two weak-wash storage vats, and washing is continued from 1½ to 2 hours, according to the grade of the material under treatment. The remaining wash solution is then pumped back to its tank, and the vacuum continued for another 15 min. to drain the cake as completely as possible when it carries 18 to 25 per cent. of solution. During this 15 min. the sluicing gates at the bottom of the hoppers are opened, and the cake is sampled by taking a grab from one side of every other leaf. Vacuum is then released and the cake assisted to fall by the use of a wooden spatula and by hosing. This residue assays about 5s. per ton. Discharging takes a little more than 10 min. with new cloths, but old cloths require an hour or more.

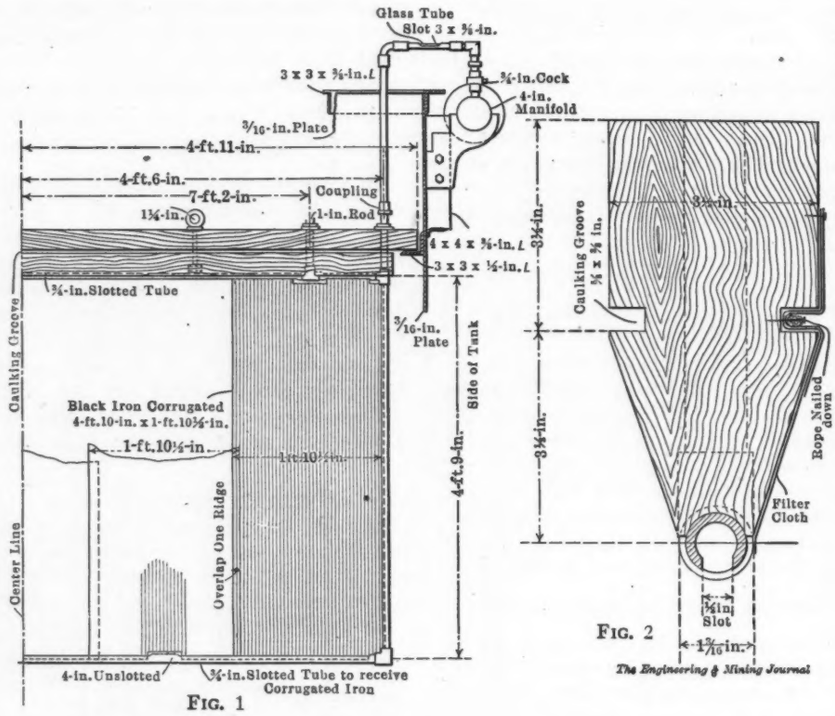


FIG. 1

SLIME FILTER LEAF USED AT TALISMAN MILL, KARANGAHAKE, N. Z.

Dumping Skip for Winze

BY K. BAUMGARTEN*

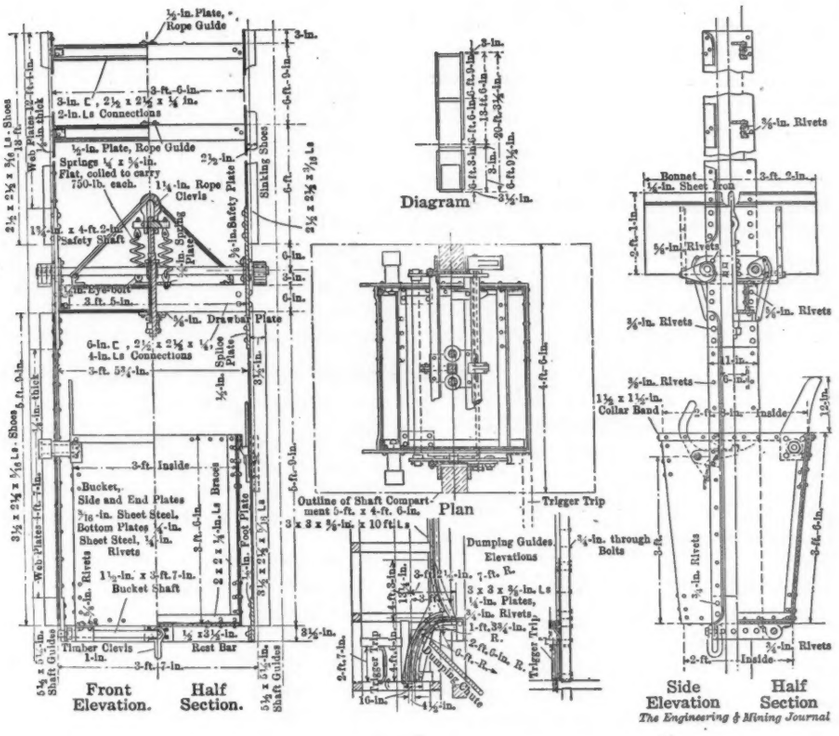
The automatic-dumping skip shown in the accompanying illustration was designed for and installed by the Black Mountain Mining Company in the vertical winze in the Cerro Prieto mine, 40 miles southeast of Magdalena, Sonora, Mexico. The skip was designed for the purposes of sinking. The total length of the shoes was 20 ft., which admitted of lowering the bucket 16 ft. below the guides. The hoisting compartments were 4 ft. 6 in. by 5 ft. in the clear; the guides were 5½-in. surfaced Oregon pine. A one-ton skip was small for the size of compartment, which was larger than usual; the problem was to arrange a bucket of convenient height for shoveling and at the same time to provide sufficient height, such that when the bucket was turning over in the dumping guides, it would not begin to empty its load until the lip was clear of the edge of the winze.

*Mining engineer, Tucson, Ariz.

The capacity of the bucket was 23.5 cu.ft., or about 1.1 tons. The shipping weight was 1732 lb. After arrival at the mine, the springs were added, the "fingers" were taken off and increased to 12 in. length, and a false bottom of 2-in. plank was put in, thus increasing the weight by about 60 lb.—a total of about 1800 lb. The hoisting equipment was a 50-h.p., three-phase induction motor, 220 volts, geared to a drum carrying about 500 ft. of ¾-in. wire rope. The load designed for this set was 3500 lb. but the hoist was operated to a depth of 400 ft. under a load of about 4000 lb., or, roughly, 15 per cent. overload, exclusive of rope weight.

The cost of the skip was $195, to which may be added $18 for freight and $3 for duty, a total of $216 at the mine. No originality is claimed for the design, except that the wearing plates within the shoes are omitted, and to which may be attributed the smooth running, as there are no projections between the shoes and the guides. In six months' operation no repairs were necessary. The dumping guides were made at the mine, but proved to cost only slightly less than the skip. It would have been cheaper to have had them made at an outside machine shop, where the equipment for such work was at hand.

An article in these columns of the JOURNAL of April 29, 1911, described the headframe for the winze in which this skip was used.

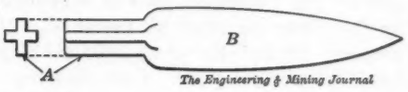


AUTOMATIC DUMPING SKIP FOR WINZE

Air Hammer Drilling in Sticky Ground

BY GEORGE E. ADDY*

The sticking of a drill steel in soft, clayey ground may be overcome by welding a piece of ribbed drill steel, *A* in the accompanying illustration, to a bull pick *B*. The drill so made can be driven with a hammer drill.

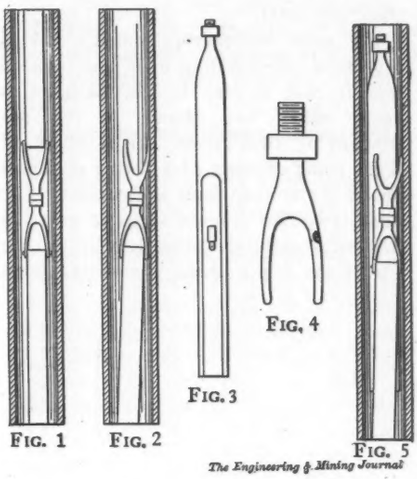


A PICK-POINTED DRILL FOR SOFT GROUND

If a set of three drills is made, the shorter steels having the larger points, a hole three feet deep can be drilled. These pick-pointed drills will be found to be time savers as compared with the usual types of drills, or with driving a bull pick with a hammer.

Pump Rod Fishing Device

A device for fishing broken pump rods is described by E. H. Harrison, Texas, in *Shop Notes Quarterly*. He says: We have a well 1230 ft. deep from which we have to pump our water, using a large lift pump. The rods are coupled together, with couplings as shown in Fig. 4, with the end of the rod put in the fork of the coupling and fastened there with brads, Fig. 1, and the couplings having male and female ends are screwed together. Sometimes the rod pulls out of the fork, leaving it in the shape shown in Fig. 2, with the fork against the side of the casing, making it unhandy to get at. The cheapest and quickest method of fishing them out is as follows:



FISHING RIG FOR BROKEN PUMP RODS

A fishing trap as in Fig. 3 is made, using 3-in. pipe, with a 2-in. slit about 4 ft. long in one side, with a steel dog on the opposite side to catch under the shoulder of the coupling. The slit in the pipe allows the fork to pass up the pipe far enough to allow the dog to catch under the shoulder of the coupling as in Fig. 5. Where the rod is broken, the pipe without the slit is used.

Wrench for Removing Stuck Drills

BY CLAUDE T. RICE

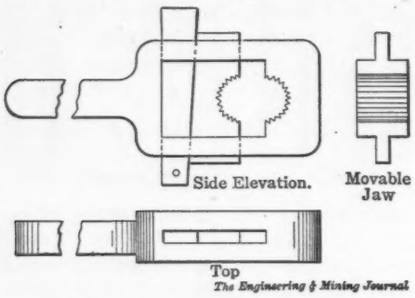
A miner often loses an hour or two through the sticking of a drill in a deep hole. If the hole is shallow, its loss is not of much consequence, but if it is deep, especially if dry and flat, and in damp ground, from which the drillings will not run, the drills stick when the miner drills farther than he should before taking out the drill and scraping out the drillings. The miner is at fault in a way, but only a small quantity of sticky drillings will wedge a drill so that, unless there is a good wrench for twisting it out through the drillings, it cannot be removed, and a new hole must be drilled.

Cruciform steel has less tendency to stick in damp holes than octagonal or hexagonal steel, as the ribs act like a conveyer to eject the drilling, provided that the hole is not too flat and the drillings are not too sticky. E. M. Weston has advised the use of drill steel with a rolled screw to overcome this difficulty

*Park City, Utah.

and on the Fort Wayne electric drill, bits with twisted shanks are used. Similar steel was used a few years ago with good results in piston drills in certain of the New York iron mines. Twisted drill steel does not stick in a hole, I understand, but it is expensive and probably not so satisfactory as octagonal or cruciform steel.

The most satisfactory wrench that I have seen for twisting drill steel from a hole is that in use in the Calumet & Hecla mines and shown in the accompanying illustration. It is made of ¾-in. iron; consists of a frame to which one of the toothed jaws is fastened. The other jaw, also toothed so as to grip the drill steel tightly, slides loosely in the slot of the frame, being prevented from



A Drill-twisting Wrench

slipping out by shoulders. Back of the loose jaw is a key, prevented from falling out by a pin through its small end. This, driven downward by a hammer, forces the teeth of the jaws into the drill steel so as to grip securely. The extension of the frame forms a handle 18 in. long, but in case this is not long enough, a piece of pipe can be slipped over it. The wrench is simply and strongly made, so that it can be hammered, twisted, and jerked without injury. It has been in use for several years at the Calumet & Hecla mine and has proved satisfactory.

Staging for High Set-ups in Stopes

In stoping in the flat-dipping veins of the Lake Superior copper mines, machine-drill posts 10 and 12 ft. long are sometimes used. When top holes are being drilled some staging must be used upon which the drill runners may stand.

This staging is often made in the following way: At a point a little farther from the face than the drill post, a piece of drill steel or better a piece of 2-in. pipe, approximately as long as the drift is high, is wedged between the hanging and foot wall in a vertical position. A second upright is placed in a similar position to one side of the other, so that a line between the two would be approximately parallel to the breast of ore.

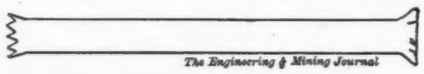
A chain is then bound around each in a series of half hitches and a clove hitch at a height above the floor a little greater than the height of the platform on which the operator desires to stand. A piece of drill steel or pipe, a few feet greater in length than the distance of the upright from the breast, is then slipped horizontally between two of the half hitches in the chain, until the end rests on a projection or in a hitch in the breast. One end of this horizontal pipe is supported by the hitch, the other by the chain. If properly hitched the chain will not slip down the upright pipes. One such horizontal pipe is supported by each upright.

The platform is made by placing two horizontal planks so as to rest across the two horizontal pieces of pipe; one in front, the other in back of the drill posts. On these planks the operators stand while drilling the upper holes.

The advantage of this staging is that it is secure, light, quickly erected, and can be adjusted to different heights by slipping the chains up and down on the uprights.

A Drill for Soft Ground

The vanadium deposits of San Miguel county, Colorado, occur in sandstone which is generally soft and often moist. The ordinary hand or machine drills are hard to operate in this sandstone because the moist sand sticks in the holes. To obviate this the miners use a hand drill made of steel tubing, in which saw



Drill Made of Steel Tubing

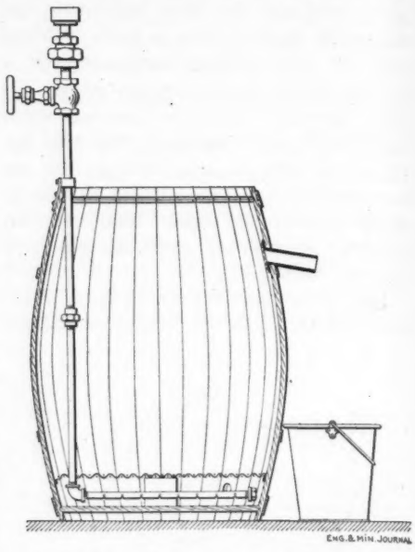
teeth are cut on the end, set out for clearance as shown in the accompanying sketch.

With this drill, upper holes are regularly drilled, the cuttings coming out of the bit through the hollow center. The device is satisfactory within the limits for drilling shallow holes in soft wet ground.

A Method of Cleaning Waste

The accompanying illustration shows the apparatus that may be used for cleaning waste with a mixture of salts sold under the trade name of "Oakite."

The barrel is half filled with water, 25 gal., with 2 lb. of "Oakite," and about 20 lb. of dirty, oily waste or rags. These are soaked 15 min. in the water made tepid by means of the steam pipe passing into the barrel, and under the screen shown at the bottom. Then the water is brought to about 180 deg. F., and permitted to remain at that temperature for about 20 min. In the meantime, the waste is stirred vigorously so that the oil freed by "Oakite" will rise to the surface. As the oil accumulates on the surface, enough water is added to raise the level of the oil to the spout, so that the oil will run off. When the surface is free from oil, the waste is taken out and dropped into a rinsing tub containing ½ lb. of "Oakite" to 10 gal. of clean water. An ordinary clothes wringer facilitates the drying. Waste,



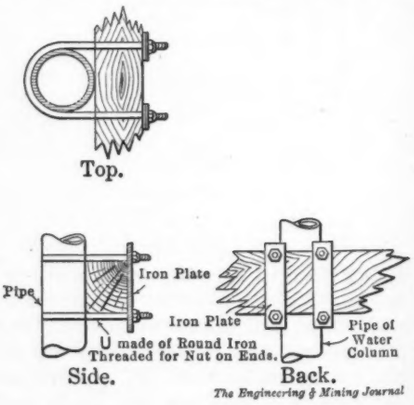
A Barrel Equipped for Cleaning Waste

cloth, or rags, smeared with grease, oil, paint, etc., can be cleaned in this manner, and used repeatedly.

Fastening Pipe to Shaft Stulls

By W. R. Hodge*

The accompanying illustration shows the manner of bolting a pipe line to the stulls of a shaft by means of U-bolts. The dimensions of the yokes used will



U-bolts for Supporting Pikes

vary with the size of the pipe. For 4-in. pipe ⅝-in. round iron and ½-in. flat plates on the back of the stulls are recommended.

The same type of bolt and plate may be used for hanging pipes in a drift where they may be tied either to the posts or caps of a three-piece drift set, or for hanging pipe from floor beams in a mill.

*Mining engineer, Eveleth, Minn.

Michigan Iron Mines Renamed

NEGAUNEE CORRESPONDENCE

The Cleveland-Cliffs Iron Co. has renamed eight of its mines in the Gwinn and North Lake districts by order of W. G. Mather, president. The "Gwinn district" is the new name for what has been formerly known as the Swanzy range. The Smith mine, in the Gwinn district, is renamed the Gwinn mine, in honor of Mr. Mather. The Kidder mine is now the Jopling mine, in honor of J. E. Jopling, chief engineer of the company. The Northwestern mine is renamed the Francis, in honor of an official of the Chicago & Northwestern R.R., which at one time owned the mine. The two mines at Cyr, where concrete shafts are being sunk by the Foundation company, will be named the Mackinaw and the Gardner. In the North Lake district west of Ishpeming, where considerable development is going on, the No. 1 mine will be named the Morris, in honor of M. M. Duncan, the general agent for the company's mining department; the North Lake No. 2 mine will be called the Lloyd, in honor of H. L. Smythe, of Harvard University, consulting geologist of the company. The Barnes mine, to the west of the North Lake mines, is renamed the Chase, in honor of P. P. Chase, of Dexter, Mich., one of the fee owners of the property. The Princeton, Austin and Stephenson mines, in the Gwinn district, and the company's mines at Ishpeming and Negaunee will retain their names.

Col. Edward D. Meier

On the 70th birthday of Col. Edward D. Meier, president of The American Society of Mechanical Engineers, which occurred during the meeting of the society in Pittsburgh last May, a number of the members united in presenting him an illuminated address of congratulation. At the same time he was asked to give sittings for his portrait. This portrait has just been finished and is on exhibition at the rooms of the society at the Engineering Societies Building, New York.

Edward Daniel Meier was born at St. Louis, Mo., May 30, 1841, and graduated from Washington University, St. Louis, and from the Royal Polytechnic College at Hanover, Germany. This was followed by an apprenticeship at the Mason Locomotive Works, Taunton, Mass. He served with credit during the Civil War.

During the 20 years following the Civil War, Colonel Meier was associated successively with the Kansas Pacific Railway, Illinois Patent Coke Co., Meier Iron Co., St. Louis Cotton Factory and Peper Hydraulic Cotton Press. In 1884 he organized the Heine Safety Boiler Co., which introduced into the United States the water-tube boiler of that name, and has been its president and chief engineer ever since. Also he was responsible for the introduction of the Diesel engine into this country, and until 1908 was engineer-in-chief and treasurer of the American Diesel Engine Co. He is a past president of the American Boiler Manufacturers' Association, and of the Machinery and Metal Trades Association.

A strong feature of Colonel Meier's presidency of the Society of Mechanical Engineers has been the broadening and deepening of the interest of the members, mainly through his active personal work. He was especially active in promoting the system of frequent local meetings of members. Another feature of his administration has been the development of the spirit of coöperation with sister societies, all tending to the solidarity of the engineering profession in distinction from the self-contained policy of a society growing without thought of its neighbors.

Superior & Boston

During the year ended Sept. 30, 1911, work at the Superior & Boston mine at Globe, Ariz., was confined to the McGaw shaft, in exploring the Great Eastern and Old Dominion veins at a greater depth. According to the fifth annual report just issued, this work included shaft sinking, 272 ft.; drifting and crosscutting, eighth level, 1215 ft.; drifting and crosscutting, 10th level, 1562 ft.; raising, 407 ft.; winze sinking, 88 ft. Costs during the year were heavy because of work being confined to shaft sinking at times and the great quantity of water encountered between the eighth and 10th levels. The latter difficulty has decreased with depth and no serious trouble is anticipated at or below the 12th level.

Exploratory work in the form of crosscuts and drifts opened the Great Eastern vein on the eighth level and showed it to be almost completely leached with only occasional copper ore in evidence in the form of cuprite, carbonate, chalcopyrite or native copper. On the 10th level at a vertical depth of 970 ft. the Great Eastern vein was cut and drifted on, exposing the first sulphide ore encountered in the mine. At this point the vein averaged about 16 ft. in width. In the west drift the ore was 9 ft. wide, assaying 6.5 per cent. copper and 2.3 oz. silver per ton, and it is said to be a good grade of smelting ore. The Old Dominion vein was explored on this level and the results were encouraging, as the work disclosed 147 ft. of mineralized vein matter. Since Sept. 30 the McGaw shaft has been sunk to the 12th level, at a vertical depth of 1170 ft. The veins above mentioned will be opened at this point. A diamond drill at this level recently disclosed the Great Eastern vein to be about 20 ft. wide, carrying chalcopyrite, bornite and little water. It is planned to sink the McGaw shaft to the 14th level and to crosscut either on this or the 12th level to the Limestone and Gardner mines where orebodies are said to be awaiting development. The McGaw shaft is equipped with a modern and uptodate plant. During the year development expenses at the mine and the office expenses at Houghton, Mich., amounted to $275,592; construction and equipment at mine, $20,735; on Oct. 1, 1911, $151,787, balance on hand.

Zinc Mining at Galena, Kan.

BY A. L. MORFORD*

Much interest is being shown by mining men and land owners, of Galena, Kan., in the plan which has been adopted by Franklin Playter, of Boston, manager of the Boston Land & Mining Co., for opening the company's 400-acre tract, situated two miles southwest of this place. Several months ago the company purchased the fee to the O'Neill No. 1 and engaged in a futile effort to work the old Rockingham lease from opencut workings at an experimental cost of $40,000. Following this failure the mill was moved to that part of the land once held under lease by the Index Mining Co., the mention of which will bring sad memories to stockholders in all sections of the United States and several foreign countries, and development work has progressed to a point where the opening of an important section of the Galena camp is now reasonably sure.

Under the plan of Manager Playter the company furnishes all equipment for mining and mills the "dirt" for half the yield. Five subleasing companies are now hauling dirt to the plant and the first turnin of blende was made recently. Near the mill site a 35-ft. face of zinc-bearing dirt has been opened above the 90-ft. level and development work shows that the length of the face is 600 ft. All shafts are within 100 yards of the mill, which has made the supplying of steam from a central boiler plant to the five hoists an easy matter. Within a week from the time of starting, the plant was placed on a double-shift basis, this being made possible by the installation of electric-lighting apparatus at the gas-engine pump station.

This is the first time such a plan has been tried by a land-owning company and it is working perfectly. In addition to those now producing ore, other companies have begun work at different places along the ore belt, which has been traced for three-quarters of a mile across the company's holdings. Mill tests already show a recovery of 7 per cent. blende which assays 61 per cent. metallic zinc with no iron.

*Galena, Kan.

Many operators have opened producing mines on the old Buckhorn 10 acres and Monte Cristo 40 acres, situated less than a mile northeast of the Boston land. The company has this land, as well as 80 acres of the Illinois Zinc & Lead Co. land and 80 acres of the Henkle land, under lease, and on these tracts the same plan is being followed with success. In the revival of interest in mining at Galena, Mr. Playter's plan has appealed to other land owners, who have endeavored to get him to take over their properties for operation on the same basis.

Another plan new to the Galena zinc district is that of Mr. Playter for making the surface of the land pay an income. He has organized a subsidiary company known as the Galena Land & Fruit Co., which will eventually put the greater part of the 400 acres to fruit. The top soil of the Shoal Creek hills is shown to be well adapted to fruit culture, being practically the same as in the Arkansas fruit district, and in the early spring 40 acres will be set to apples, peaches, pears and cherries. The lay of the land is such that it can be easily irrigated from a reservoir placed near the concentrating plant, which is supplied with water from Shoal creek. The greater part of the land is covered by "jack" oaks but the timber will pay the clearing charges.

Minerals Separation Co. Sues

BUTTE CORRESPONDENCE

In the Federal court at Helena, the Minerals Separation Co., Ltd., and the Minerals Separation American Syndicate, Ltd., recently instituted suit against James M. Hyde, of Basin, for alleged infringements of patents in processes for the concentration of zinc ores installed by him some time ago in the Basin plant, where the Butte & Superior ore is being treated. It is alleged in the complaint that the processes used by Mr. Hyde were invented by Henry Livingston Sulman, John Ballot and others, of London, and that letters patent to them were issued by the United States patent office in 1906, the complainants succeeding to their rights in 1910. It was also asserted that Mr. Hyde was employed by the Minerals Separation Co. for about a year, terminating in February, 1911, during which time he was instructed in the use and installation of the processes, after which, without license from the company, he installed apparatus for use at Basin, from which he has received large profits. It is asked that an injunction be granted to restrain Hyde from using the processes during the pendency of the action; then a permanent injunction; and when a decree is entered, an amount in damages not exceeding three times the amount of the profits accruing to Hyde, as a result of the alleged infringement. Mr. Hyde has filed an answer denying that the processes originated with the English inventors and asking that the suit be dismissed. Officials of the Butte & Superior Co. have stated that the suit has not affected the operation of the mill.

New Equipment at Negaunee Mine, Michigan

BY P. B. MCDONALD*

The Cleveland-Cliffs Iron Co. is equipping its large Negaunee mine, at Negaunee, Mich., with a costly plant. This property is estimated to have 14,000,000 tons of ore available, and the underground workings are connected with the adjacent Maas mine, of the same company, which is credited with an orebody of 10,000,000 tons. The Negaunee mine has been worked through two old wooden shafts, but a new circular, concrete shaft is now being finished; this shaft is lined with concrete in a manner similar to the Brier Hill shaft of the Penn Iron Mining Co., at Vulcan. It was not necessary to use compressed air and caissons nor was the drop-shaft method employed, as the surface is but 45 ft. deep; sinking was carried on in the usual manner and the concrete put in as lining instead of timber. The shaft is 17 ft. in diameter inside, and is down 935 ft.; there will be but two levels, the top one being 750 ft. from surface.

STEEL STOCKPILE TRESTLE

An unusual feature at this mine is the steel stockpile trestle under construction. It was computed that the cost of erecting the customary wooden trestle every year, to be torn down to make room for the stockpile steam shovels during the shipping season, would pay for a permanent steel trestle to be built on a line of cylindrical concrete posts, between which the steam shovels could work without interference. The trestle is 3000 ft. long, extending an equal distance in either direction from the shaft. The rails are supported on heavy girders, which are held up on a single line of reinforced-concrete posts, about 100 ft. apart and each about 5 ft. in diameter. On account of the absence of all supports except the cylindrical posts and the minor bracing at the top of the posts, the stockpile steam shovels can scrape up the ore as well as under the old method, in which the wooden bents fell or were torn down so that the ore could be removed. The posts are reinforced by 60 vertical steel rods, of which 36 are in the outer ring; a thin steel plate covers the concrete and serves to attach the bracing at the top of the post. These steel cylinders also served as forms for the concrete and were made complete, like a smokestack, before being shipped to the mine. Each post rests upon a concrete foundation 6 ft. deep and built up flush with the ground; the foundation is stepped up in a pyramid, being 28x14 ft. at the base, and but little larger than the cross-section of the post, at the top. The foundations are reinforced with horizontal steel rails, under which the foundation bolts are hooked. It is estimated that 1,500,000 tons of ore, or about three years' product, can be stocked from the trestle.

*Mining engineer, 102 West Main St., Negaunee, Mich.

UNUSUAL FLYWHEEL USED ON HOIST

Hoisting at the Negaunee mine will be done by electricity, furnished by the new power plant under construction on the Carp River, near Marquette, by the Cleveland-Cliffs company. A feature of this hoist is the heavy flywheel which will revolve at a high rate of speed so that its momentum will allow it to be under load for 1 hr. with the electric current shut off, before it stops; it will take 4 hr. to stop without load. A small amount of power, possibly 75 hp., will suffice to keep the wheel going and the drain on the electric current will be constant, being unaffected by the starting and stopping of the hoist. This flywheel is 12 ft. in diameter and 7 in. thick; it is made up of ½-in. steel plates riveted together and weighs 15 tons. The electric current received at the mine will be stepped down from 2200 volts to 300, and will be changed from alternating to direct current; the motor generator is the largest the Westinghouse company ever made. There will be two hoists, one direct connected for hoisting ore and one geared hoist for men and timber.

The new dry at the Negaunee is of brick and of the low, long pattern that the Cleveland-Cliffs company has standardized; like the mines in the Gwinn district there will be an underground tunnel from the dry to a station at the shaft below the surface of the ground; this will make it unnecessary for the miners to go outdoors in wet clothes. The engineer in charge of this construction work is C. J. Stakel, of the Cleveland-Cliffs company.

Chlorination Abandoned at Colorado City

DENVER CORRESPONDENCE

The closing of the Standard mill, at Colorado City, Colo., the principal works of the United States Reduction & Refining Co., has been announced, and its custom ores from the Cripple Creek region will go to the Golden Cycle Mining & Milling Co., to whom the field is practically abandoned. This is the outcome of the rate war started by the former company about three years ago, in order to do away with the competition of the smaller plants and the custom business of the Portland and Golden Cycle mills.

J. Dawson Hawkins, president and general manager, has issued a circular to

the producers with whom the company has contracts, informing them that he has arranged with the Golden Cycle company to handle their ores at contract rates, and instructing them to make shipments, commencing Dec. 1, to that company.

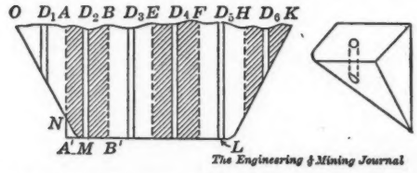
Sampling Errors Due to Copper Bar Shapes

By Donald M. Liddell

The chief objections to the sampling of the old-style copper bars which have been urged in print were the great segregation ratio existing in thick bars, and the difficulty of handling them in the drill rooms, which resulted both in higher labor costs and in more broken and burned drills. Apart from these detriments, there is an insurmountable theoretical objection, which also pertains to certain comparatively thin, but greatly beveled copper slabs.

Size-weight Ratio Often Incorrect on Edge Sections

In the accompanying illustration is seen a cross-section of a copper bar, pierced by the drill holes D_1, D_2, D_3, . . . D_6. Theoretically drill hole D_2 represents the average of the block $A\,B$, D_4 the average of the block $E\,F$ and D_6 the average of



Section through Drilled Copper Bar

the block $H\,K$. If the weight of drillings taken from hole D_2 be represented by W_2, and the weight of the drillings from hole D_4, by W_4, etc., then in the figure shown, although W_4: vol. $E\,F$: : W_6: vol. $H\,K$, the proportion will not hold for block $A\,B$. This admits of rigid mathematical demonstration, but is self evident in the figure, because the drill hole D_2, of the same size as D_4, in reality corresponds to a block whose corners are $A\,B\,B'\,A'$, that is, W_2 is in excess of the weight which should be drilled from a block corresponding to $A\,B\,B'\,M\,N$, since a portion, $M\,N\,A'$, of the theoretically corresponding block is non-existent. That W_6 has the proper size-weight ratio may not be evident at first, but is true, since a block lying entirely on the bevel of the pig is equivalent to a rectangular parallelopiped of the same base and half its altitude, while the drilled-out hole is equivalent to a hole through such a block, while the weights of this block and the full block $E\,F$ are proportional to their altitudes. If the size of the length $A\,B$, corresponding to the size of the templet squares, be such that the hole D_2 come on the bevel of the pig, then W_2 will be a lesser weight than corresponds to the volume $A\,B\,B'\,M\,N$.

In the above, it is clear that the tacit assumption has been made that the total weights of the sections $A\,B$, $E\,F$, etc., are to each other as the volumes. That the relation actually holds that any given cubic inch of a copper bar is equivalent in weight to any other given cubic inch is untrue, for the center of a bar of converter copper is of greater specific gravity than is the periphery, but for sections cut from top to bottom the assumption is so nearly true that the error made by it is less than the size-weight error discussed above. Indeed it happens as often as not, that the error introduced by the specific-gravity differences intensifies the size-weight errors. However, to return to the discussion of size-weight errors in a theoretical copper bar of uniform density.

It may be urged that the ordinary copper bar is not a thing of absolute acute angles, but that the corner at M is somewhat rounded, and that this may exert a corrective influence. This is true to the extent that given a certain geometric solid representing a right prism whose section is an isosceles trapezium, of which the obtuse angles have been rounded off, it is possible, albeit not easy to calculate such a position for the drill hole D_2 as will give the same size-weight ratio as do the other drillings.

Templet Squares Must Be of Practical Size

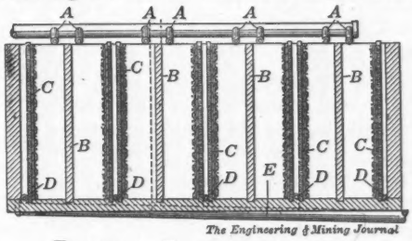
Moreover, when it comes to practical work, although the templet is a fixed one, based on the average size of a large number of pigs, and consequently the size-weight ratio will not hold in many individual pigs, the average will be correct, which after all, is the underlying basis of copper drilling. However, to get the placement of this hole to give the correct size-weight ratio often means an inconveniently, if not impossibly large number of holes to the templet, and leads us again into difficulties.

It may be asserted in the figure given, if the figure $K\,L\,M\,O$ were a bar section with unrounded angles at $L\,M$, that the distribution of holes which would obtain could one of the templet-section boundaries, such as $A\,B$, pass exactly through M, would be theoretically perfect. So it would, but this would still leave four pyramids at the corners in which the drill hole, coming in the middle of the square base, will not give the size-weight ratio of all the other sections.

These differences in an observed case amounted to as much as 6 per cent., that is, the edge holes contributed only 94 per cent. of their theoretical quota to the general sample. I will not say that this is the maximum error possible. I have tried in vain to calculate a thick bar with rounded lower edges and corners which should be so proportioned that the size-weight ratio of all drill holes should be the same. While the problem may not be impossible, it is so difficult, that from its underlying mathematical considerations I have used the word insurmountable in referring to the difficulties of obtaining such a sample. The cure is easy, cast thin slabs with small taper. Meantime, it is not difficult, knowing that this source of error exists, so to lay out the templet for any particular bar that the evil will be greatly diminished.

Farnham Electrolytic Cell

The electrolytic cell patented by F. F. Farnham was described in the Journal of Dec. 2, 1911, p. 1084, but the illustration was omitted. It is given herewith, showing the cell in vertical section. The



Farnham Electrolytic Cell

electrolyte feed pipes are shown at A, the cathodes at B, the hollow anodes with supported diaphragms at C, the anolyte pipes at D, while at E is shown the outflow pipe.

Zinc Dust

A new ruling of the Interstate Commerce Commission lists zinc dust and zinc flue dust as inflammable solids and directs that they must bear a yellow shipping label, as prescribed in paragraph 1834, which reads: "Packages must be tight and strong, and the interior packages must be so cushioned and secured that no rupture of either package can result from the ordinary shocks incident to transportation."

Zinc dust is commonly shipped in wooden casks containing 1500 lb. It has been for a long time recognized as a dangerously inflammable substance and there has been a strong suspicion that also it is explosive, although the causes of explosions in which it has figured have not, perhaps, been conclusively traced to the zinc dust. However, it seems to be considered that the preponderance of evidence points that way, an opinion with which we concur.

The big Corliss engine which was a prominent figure in the machinery department of the Centennial Exposition at Philadelphia in 1876, and which was a notable example of the advanced engine construction of that day, has ended its career. It has been doing duty for many years in the works of the Pullman Company at Pullman, Ill. It has now been sold, with several other old engines, to the Oakdale Iron Company, of Chicago, and will be converted into scrap.

A Dry Land Dredging Machine

By Lewis H. Eddy*

Description of the Hearns-Martin placer-mining machine used near Oroville, Cal., for working the shallow gravel of Thompson flat where hydraulicking is barred by the tailings-disposal law.

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There are many hundreds of acres of shallow placer lands in California that cannot be economically worked with the modern type of bucket-elevator dredge employed in the stream beds and chiefly designed for deep digging of large areas. These shallow lands are barred from hydraulic methods by the provisions of the Caminetti act, which requires certain methods of impounding the tailings. The necessary water for the operation of a hydraulic plant is usually available even in dry areas through flumes and ditches carrying water for varying distances; and the same method of water supply may be readily adapted to the needs of the bucket dredge; but the laws of legislation and economics are rigid and insurmountable. So the desire to recover the gold known to remain in much of the land that was ground sluiced by the early-day placer miners has fathered the invention of a gravel-washing machine that may be operated without violation of legislative provisions and within the economic requirements of profitable placer mining.

HEARNS-MARTIN EQUIPMENT FOR WORKING THE SHALLOW GRAVEL OF THOMPSON FLAT, NEAR OROVILLE

HEARNS-MARTIN MINING MACHINE

The digging and moving of this character of placer ground with portable machines is merely a matter of choice of methods. The steam-shovel, the clam-shell, or orange-peel bucket, or other devices may be readily adapted to the loosening, conveying and depositing of the gravel, sand and soil; but the washing of the material and the economic disposition of the tailings with a machine capable of moving in line with the digger was an engineering problem not readily solved.

The first attempt at the solution, bearing evidence of successful accomplishment, has been made at Oroville within the last two or three months by the employment of the Hearns-Martin placer-mining machine, operating at a point within two miles from Orville and known locally as Thompson flat. This flat contains 98 acres of placer ground extending from a low line of foothills, and having a slight pitch, but sufficient for the gravitation of the water used in the machine back to the supply reservoir with small percentage of loss through seepage. The contour of the land and the topography of the neighboring hills form an ideal situation for the practical experimenting of the machine in operation; but, although the adaptation of the method to more rugged ground may require some changes and improvements in mechanical construction and engineering detail, a careful inspection of the machine in its operation on this ground seems to warrant the belief that it may be as satisfactorily and profitably adapted to varying contours. The portability of the machine and the applied mechanism for the disposition of the tailings would remain the same in any character of dry land of 2 to 10 per cent. grade. The land composing Thompson flat has a 3 per cent. grade.

MARION SHOVEL USED

The digger employed at this plant is a Marion, model 35, traction shovel, 1 cu.yd. capacity, operated with oil fuel and capable of delivering one bucket per minute to the hopper of the washing machine. The device for washing the gravel is designed on the same general lines employed in the construction of a bucket-elevator dredge, including hopper, revolving screen, nozzle washer and riffles. The machine is mounted on a truck constructed entirely of steel I-beams and channels; length of body, 11 ft., width 9 ft. 4 in., carried on four traction wheels 24 in. wide by 58 in. diameter; axles of hammered steel; the rear axle is attached to a king pin and steering gear operated by pilot wheel. A heavy cast-iron bed plate is mounted on this car, accurately bedded and bolted to the car; on this casting is the turned roller path on which the washing machine turns. This bed casting also receives and secures a steel center pin or post, which receives the stresses, due to the dumping of the gravel into the hopper. The washing machine is turned on this bed-plate to distribute the tailings into the cut made by the shovel.

THE WASHING APPARATUS

The hopper for receiving the gravel to be washed has a capacity of about 3 cu. yd. Water is furnished to the hopper through a 2-in. pipe, under 20-lb. pressure, with three streams playing on the gravel and feeding it into a mixing drum, 5 ft. diameter, and 4 ft. long. This drum is riveted to a revolving screen, and has

a chute fastened to the screen end of it, which allows about 2 cu.ft. of gravel to discharge into the screen at each revolution of the drum. This mixing drum holds about 14 in. of water, which thoroughly mixes with the gravel, the movement of the drum creating sufficient agitation to strip the gravel and cause most of the gold to settle in the first series of riffles.

The revolving screen receiving the gravel from the mixing drum is 3 ft. diameter by 12 ft. long, made to fit the condition of the ground to be worked; the holes in the screen of the machine here in operation are ⅜ in. inside and $\frac{7}{16}$ in. outside; where coarse gold occurs the holes may be made larger. At the lower end of the revolving screen is placed a 3-in. adjustable nozzle, reduced to a 1-in. opening, which throws a stream under 85 to 100-lb. pressure, furnished by a turbine two-stage pump direct connected to a 15-h.p. General Electric motor, with a speed of 1800 r.p.m. Water is furnished to the suction of this pump through a 3-in. canvas hose attached to a pipe line. The thorough stripping of the gravel in the mixing drum renders unnecessary the employment of nozzles at the upper end of the screen.

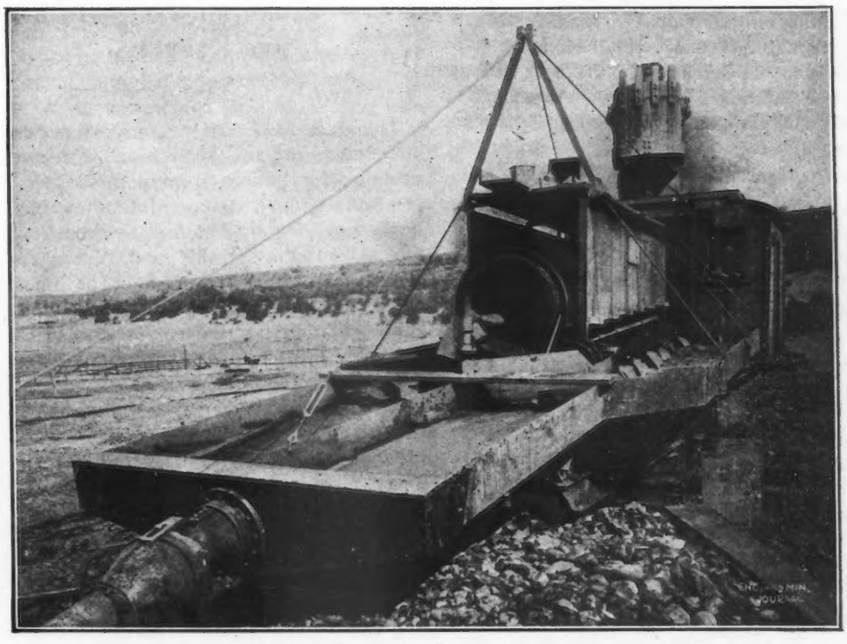
Washing the Gravel

The screened gravel and sand are caught in distributers and carried over the riffles constructed at the sides of the revolving screen. When the tailings gravel reaches the lower end of the revolving screen it drops on a rock chute and is thus deposited through an opening between the sluices and caused to fall on the bottom of the cut made by the shovel. At the top of each sluice coming from the distributers there is installed a quicksilver riffle, and the water coming from the revolving screen and mixing drum keeps the quicksilver clean and causes the gold to amalgamate. Each sluice is supplied with water through a pipe, these pipes being connected to an 8-in. main line supplied by a 3-in. canvas hose connected to a hydrant. The third line of hose furnishes the hopper with water.

All water used on the machine runs over riffles and is concentrated in a box at the end of the machine, which has a 12-in. opening about 4 in. from the bottom of the box; this box acts as a quicksilver trap, so that only a small percentage of quicksilver is lost. The water and fine gravel and sand from the riffles are carried through the opening in the box and into an 8-in. pipe, with a swivel joint, attached to the box. This swivel joint allows the pipe to be swung at any desired angle and thus deposit the fine material and water on top of the coarser gravel and rocks that have been dumped from the lower end of the revolving screen.

Restoring the Land

The adaptability of the machine to the distribution of the tailings across the cut from which the material was taken, placing the heavy gravel and rocks at the bottom and the lighter material on top, enables the operator to restore the land to its former condition, or to put it in even better condition for agricultural purposes than when the work was begun. The method of mining the land is to start at the bottom of the pitch or grade and work up hill; thus the pit dug by the shovel is kept dry and the water used by the machine gravitates back to the reservoir, where it settles and is again ready for the same use. The water thus passing by gravity through the surface ground is partially clarified before reaching the reservoir, and by reason of this, and the settling in the reservoir, the cost of water where it must be purchased is reduced to a minimum.



Discharge End of Hearns-Martin Machine in Use at Thompson Flat

Electric Power Used

The mixing drum and revolving screen are driven by a 20-h.p. General Electric motor, which runs at a speed of 865 r.p.m.; this motor and the pump motor are equipped with automatic starters and connected ready to run when power cable is attached to the main fuse block. The screen drive motor is equipped with a Peerless V-belt driving the main shaft, having a bevel pinion which engages with a bevel gear on the tread-roller shaft on the left side of the machine; this tread roller engages with the tread ring, which is riveted to the mixing drum. All gears, rollers and tread rings are made of cast steel. Power is furnished by the Oro Water, Light & Power Co., of Oroville, over a 3-phase 2300-volt line stepped down to 440 volts.

The reservoir occupies one-half acre of ground and is 3 ft. deep, situated at the lowest part of the land. About 5 in. of clear water is required to keep the reservoir full and allow for seepage and evaporation. About 50 in. of water is used on the washing machine, supplied by a 6-in. pump. The pump and transformer house is situated 100 ft. from the reservoir and 1800 ft. from the farther end of the land that is being worked. Beneath the pump house there is a sump, connected with the reservoir by a flume with gate to regulate the flow of water. In addition to the gate a hinged-board trap is so arranged and connected that when the water rises too high in the sump an electric bell is rung as a warning. The water is carried to the washing machine through an 8-in. slip-joint pipe line, having connections 200 ft. apart for 5-in. hydrants.

This traction shovel will dig a cut about 40 ft. wide at the bottom and 7 to 10 ft. deep; the shovel has a 16-ft. clear ance when the dipper is up and the door is open, to clear the top of the hopper of the washing machine. The shovel machine is capable of drawing the washing machine behind it over ordinary roads, and is equipped with an extra drum or winch, which is employed to move the washing machine ahead when working on steep grades or in soft ground. When the machines reach the upper end of the cut they are run back to the bottom of the grade and the second cut is started alongside and run parallel with first cut.

At the time my visit was made to this plant, in the first part of November, the

machines were in the fourth cut. These cuts are about 40 ft. wide, an average of 7 ft. deep, and 300 to 1000 ft. long. The work accomplished represented about three months' operation, including necessary stops for such changes in the mechanical construction as the experimenting demanded. There was no time in the operation of the machines when the distribution of the tailings was in the least problematical; but in the early operation clearing the land of the water coming from the washing machine was not efficiently provided for, and there was danger of flooding portions of the land, and evident lack of economy in the use of the water. This was soon remedied by the attachment of the 8-in. swivel-joint pipe to the end of the trap box, through which the water and fine gravel and sand are advantageously distributed. Various mechanical and engineering details have been improved during the three months' initial run, resulting in an apparently practical and economic application of scientific methods to shallow placer mining. The plant here described is under the management of J. C. Martin, Jr., 210 Balboa building, San Francisco; L. N. Hearns is superintendent.

High Voltage Transformers

The high potentials required for the economical transmission of electrical power to great distances make imperative the use of transformers of great electrical and mechanical strength to withstand the heavy disturbances on these long transmission lines and provide dependable service. The General Electric Company aims to meet these requirements in its type H (core type) transformer.

Some of the new features of this line of transformers are as follows: The original method of fastening the laminations together with horn-fiber channels and shellacked wooden dowel pins is superseded by the use of insulated metal rivets. The interleaving of the yoke laminations with the leg laminations is retained, having proved superior to other forms of joints. A supporting plate furnishes additional mechanical reinforcement to the outside laminations.

The clamps for the yoke laminations consist of steel angle plates. The coil supports engaging with the steel angle plates consist of treated wooden blocks providing generous bearing surface for the coils. On the higher-voltage designs this wood is supplemented by wet-process porcelain parts, giving greater insulation strength without loss of mechanical strength.

The tank for the self-cooled transformer consists of a corrugated steel body amalgamated with a cast-iron base and cast-iron rim. For the water-cooled transformers, the body is of smooth cast iron, which, with the base and rim, is made in one piece. The cooling coils for these transformers have both inlet and outlet brought out at the side below the oil level so that no portion of the cooling coil is exposed to the air, effectively preventing any condensation of moisture from the atmosphere and consequent deterioration of the oil.

The cylindrical windings of core-type transformers are retained, as this design has proved to be the strongest both electrically and mechanically. The "compounding" of the coils by the vacuum process, i.e., the complete removal of all moisture and air before the impregnation with an oil-resisting insulating compound, insures a construction able to withstand the frequent strains and surges, both of normal and high frequency, daily occurring on large high-voltage systems.

Labor Conditions on Minnesota Ranges

WASHINGTON CORRESPONDENCE

The U. S. Immigration Commission has completed, and will soon issue, a report dealing with the iron-ore miners of northern Minnesota. This report will show that only about 5 per cent. of the men employed on the Mesabi and Vermilion ranges are native Americans. The other employees by race are Finns, Slovenians, Croatians, Italians, Poles, Slovaks, Montenegrins, Norwegians, Swedes and English. On the Vermilion range the underground mining system calls for greater skill and a larger number of native Americans is employed than on the Mesabi range, where openpit mining predominates.

EARNINGS AND FAMILY INCOME

The earnings of the mine workers compare favorably with those received by employees in Michigan iron-ore mines and the bituminous regions of the East and Middle West. A recent and exhaustive investigation by the Federal Government showed that the weekly earnings of native-born employees of foreign father average $15.44; the average for all mine workers was $14.30 per week. The average annual earnings of native Americans who were the heads of families were $1024, and of foreign-born heads of families, $659. The average total annual income of native American families was $1058, as contrasted with $995 for all classes of immigrant families. The family income, in addition to the earning of the husbands in the mines, was derived from the payments of boarders and lodgers in the homes and the contributions of children, who were in domestic service or working for wages outside the home. Almost all, or 97 per cent., of the income of American families was obtained from the earnings of husbands, the remainder consisting of contributions of children. On the other hand, the immigrant families derive 70 per cent. only of their income from the earnings of husbands, the other 30 per cent. coming from the payments of boarders and lodgers. This practice in immigrant households of keeping boarders and lodgers in order to supplement the earnings of the husband causes bad living conditions and a high degree of congestion.

WORKING CONDITIONS AND ACCIDENTS

During the shipping season on the Great Lakes, 10-hour periods, on both day and night shifts, are worked on both ranges. The situation in the Mesabi region and the prevalence of openpit mining prevents full-year operation in all departments; the production of ore stops when transportation by water becomes impossible and a reduction in the operating forces becomes necessary. On the Vermilion range, the mines may be operated even in the most severe weather.

The number of accidents, both fatal and nonfatal on the Minnesota ranges, when the methods of mining are taken into consideration, is large. A comparison in the proportionate number of fatal accidents in the iron-ore mines and the bituminous coal-mining districts of the country, shows little difference. The causes of this high accident rate on the Minnesota ranges, according to the report, are as follows: (1) Laxity in mine discipline, growing out of a demand for labor greater than the supply. The result has been the employment of inexperienced labor and the countenancing of intoxication in the labor gangs. (2) Absence of any law enforcing the companies to employ only trained miners in the responsible and dangerous positions. (3) Inability of the majority of employees to speak English and to understand the orders and directions given them. (4) Carelessness and recklessness on the part of many of the men employed.

Fuller's Earth in Texas

The expansion of the petroleum and cottonseed-oil industry in Texas and the demand for high-grade fuller's earth elsewhere has given a new impetus to the development of this material in the State. Fuller's earth, of excellent quality, has been found in Ellis, Burleson, Shelby, Smith, Fayette and Washington counties. The best known deposits are in Burleson county, near Somerville; in Washington county, near Burton and in Fayette county, near O'Quinn and Muldoon. So far as known, at present, the largest deposits are in Fayette county and more is being done there for their development than elsewhere in the State. In 1910, Texas produced 864 tons, valued at $9.93 per ton, according to William B. Phillips, of the Texas Bureau of Economic Geology and Technology.

Electric Hoists for Mines

By D. B. Rushmore*

Four systems of motor hoisting are discussed. The running speeds of motors being limited, some system of balancing the power during the periods of starting and acceleration is necessary in order to avoid excessive peak loads.

NOTE—Excerpt from a paper entitled, "Electricity in Mining," read at the meeting of the American Mining Congress, at Chicago, Oct. 24 to 28, 1911.

*Engineer, power and mining department, General Electric Company.

Large electric mining hoists are almost universally driven either by shunt-wound direct-current motors, or polyphase induction motors, the characteristics of which especially adapt them to meet the peculiar conditions imposed. While in many of their characteristics these two types of motors are similar, they differ widely in others, which are of more or less importance, depending upon special conditions of individual cases.

Speed Change in Motors is Small

The free running speed of either motor is limited, and the speed variations with load changes are small. When driven above their normal speed both act as generators and may, therefore, be used as a brake when lowering unbalanced loads, returning power to the supply system. The speed of the shunt-wound motor for a given load may be varied between standstill and full speed, either by changing the potential of the supply system, or by inserting resistance in series with its armature. However, because of the inefficiency of the latter method, it is seldom, if ever, used in connection with large hoist motors.

The only practical method of obtaining a similar variation in the speed of an induction motor is by changing the amount of resistance connected in its armature circuit. Where the conditions, however, are such that it is desirable to run the hoist at a reduced speed for any length of time, the efficiency of the induction-motor drive may be improved by using a motor designed for two speeds, but the advantages gained thereby are seldom sufficient to offset the increased first cost and the necessary complication of the control.

Necessity of Speed Control

The efficient speed control of the shunt motor may be obtained by varying the voltage of the supply system; the usual method is to provide a generator for each motor and vary the generated potential. As mine shafts are usually scattered over a large area, and the conditions in close proximity to the shaft are not such as to permit of the economical generation of electric power, the central station is usually placed at a considerable distance from the hoist; the power is generated and transmitted to the mines as alternating current, and is then transformed at each shaft into direct current by motor-generator sets. The losses caused therein must be charged against the shunt motor when comparing its efficiency with that of the induction motor, which may be connected either directly or through highly efficient static transformers with the alternating-current distributing system. The torque and current for the two types of motor are approximately proportional within their operating limit.

Many systems of electric hoisting have been prepared, each with the view of meeting some particular condition, or eliminating some real or apparent objection in the others, but virtually all the installations are confined to four systems.

Polyphase Induction Motors Controlled by Water Rheostat

The first and simplest system consists of a polyphase induction motor, direct connected or geared to the hoist drum. The speed of the motor is controlled by a variable resistance in its rotor circuit. Because of the magnitude of the currents involved, this resistance is commonly some form of water rheostat. A common type of water rheostat consists of a tank usually of boiler plate riveted together, and divided into two compartments; one the rheostat proper and the other a cooling tank. The electrolyte is pumped from the cooling tank into the rheostat proper, entering at the bottom of the rheostat and flowing out over the top on an adjustable weir, back into the cooling tank. The resistance in the rotor circuit is varied by changing the hight of the electrolyte in the rheostat proper by means of the adjustable weir. The electrodes are usually thin iron plates hung on insulators, all phases being in the same compartment. At least one electrode per phase is of extra length, extending below the lowest level of the liquid, in order to prevent the rotor circuit from being opened. The most common form of electrolyte is a simple salt solution. The control of the rheostat is by means of a lever on the operating stand.

The power taken by the motor in this system is constant during the period of acceleration, but the efficiency for this period is low, approximately 45 per cent. No power is returned to the supply system during the period of retardation, and the power consumption for small movements of the cage or skip is large. On the other hand, the efficiency during the period when the hoist is running at full speed is high, approximately 90 per cent., and no power is consumed while the hoist is at rest.

The efficiency over the complete cycle of operation obviously decreases rapidly with a decrease in the time during which the hoist is driven at full speed; and it follows from this that when hoisting is to be done from several levels, the efficency at the maximum depth alone cannot be used as a basis for comparing the hoist driven by the induction motor with other systems. The efficiency of the cycle increases with an increased rate of acceleration, from which it follows that an induction motor for hoisting should be designed for a high maximum output to permit of a rapid acceleration. The power returned to the system in lowering the empty skip is approximately 20 per cent. of that taken by the motor in hoisting the loaded one.

Using Direct-current Motors

In the second system the hoist is driven by a direct-current shunt motor, receiving power from the alternating-current supply system through a synchronous or induction motor-generator set. The hoist motor is controlled by varying the voltage of the generator which is separately excited, one generator being used for each motor. The power consumed during acceleration is much less than for the induction hoist motor, the efficiency being approximately 80 per cent.; and a considerable part of the energy stored in the revolving part of the hoist is returned to the supply system as the hoist is brought to rest. On the other hand, the efficiency, when the hoist motor is running at full speed, is lower than that for the induction hoist motor, being approximately 82 per cent., and the losses of the motor-generator set, when running light, must be supplied during the time when the hoist is at rest. In view of the fact that a mine hoist is idle 50 per cent. or more of the time under ordinary conditions, this is an item in the total power consumption which cannot be neglected. It follows from what has been stated that the advantage of the direct-current hoist motor over the induction hoist motor in the efficiency through the complete cycle is greatest for short lifts, in which case the period of acceleration is a large percentage of the total cycle, and the time during which the hoist is idle is a minimum. When the empty skip is lowered with this system, about 30 per cent. of the power consumed in hoisting the ore unbalanced, is returned to the system.

Most Efficient System Expensive to Install

No definite rule can be laid down by which a choice can be made between the two systems, each having advantages and disadvantages, peculiar to itself, which have a more or less important bearing on the choice, depending upon the special conditions of the individual problem. The first system has the advantages of low first cost and simplicity, but is often at a disadvantage in respect to efficiency. On the other hand, the higher efficiency of the second system is frequently more than offset by its increased first cost, and its greater cost of maintenance.

Both systems are open to the objection that the power drawn from the supply system fluctuates between wide limits during each cycle, generally reaching a maximum during acceleration, becoming negative during retardation; for the second system, zero, or practically so, at the end of the cycle, and negative for both systems when lowering unbalanced loads. The effect of this wide fluctuation in the load during each cycle is to impair seriously the voltage regulation of the supply system, unless its capacity is large, as compared with the fluctuations, or unless the number of hoists driven from the same system is sufficient to produce a fairly uniform load. This is seldom the case for a mine power system. Also, if power is purchased, the price is usually made up of two components; one based on the total kilowatt-hours consumed, and the other on the maximum demand.

Flywheel to Equalize Power Demand

It, therefore, becomes necessary in most cases to provide some means whereby power may be taken from the supply system, and stored during the portion of the cycle when the demand for power is less than the average, and returned when the demand exceeds the average.

Such a system is the third, in which advantage is taken of the low first cost and efficiency of the flywheel as a means for storing and returning large quantities of power for short intervals. This system is similar to the second, except for the addition of a flywheel to the induction motor-generator set, and an automatic regulator for varying its speed. In its most common form, this regulator consists of a water rheostat connected in series with the induction-motor armature. The resistance is varied by means of a movable electrode suspended from an arm mounted on the shaft of an induction motor, which is connected in series, either directly or through series transformers, with the induction motor of the flywheel set. The regulator motor is so connected that its torque opposes the weight of the electrodes, which are partially counterbalanced to reduce the size of the regulator motor to a minimum, and to permit of an adjustment of the regulator for different values of line current. When the line current exceeds the value for which the regulator is adjusted, the torque of the motor overbalances the weight of the electrodes, lifting them and inserting resistance in the armature circuit of the induction motor. This causes it to slow down, and allow the flywheel to assist in driving the generator during the peak loads.

Peak Loads Eliminated by Using Induction Motor

The fourth system is used, when, for the purpose of meeting some peculiar condition, it is advisable to drive the hoist by an induction motor, and at the same time eliminate the peaks from the station load. The adoption of this system is warranted when the hoist is at such a distance from the surface that it becomes necessary to transmit power to it by alternating current, and when the shaft is not large enough to allow the flywheel of the motor-generator set to be taken underground.

This system is the first to which has been added a converter equalizer at the surface, and includes a rotary converter connected on the alternating-current side to the supply system, and on the direct-current side to a motor driving a large flywheel. The field of the direct-current motor is controlled by a regulator actuated by the line current. When the power taken by the hoist drops below the average, the field of the flywheel motor is automatically reduced, and the flywheel is speeded up, the power being taken from the supply system. When the hoist-motor load exceeds the average the operation is reversed, the flywheel slowing down and returning power to the system.

The efficiency of this system is generally slightly lower, and the weight of the flywheel is slightly greater, than for the direct-current motor and the flywheel motor-generator set. It has the advantage, however, over the third system, in that the operation of the hoist motor is not dependent on the operation of a converter equalizer. Consequently, in the event of the failure of the latter, hoisting may be continued, provided, of course, that the capacity of the power system is sufficient to take the load, which would be the case if the equalizer were used simply to reduce the power bill.

Either the third or the fourth system may be used where the supply system is direct current; in the third system, by substituting a direct-current motor for the induction motor of the flywheel motor-generator set, and in the fourth system by omitting the synchronous converter of the flywheel converter system.

Electric More Economical than Steam Hoists

A comparison between the steam system and these four electrical systems is given in the accompanying table, in which the fuel and ore ratio for each are given for a small system hoisting from a 2000-ft. level and a large system hoisting from a 6000-ft. level.

In determining these values, it is assumed that the steam-hoisting engines are noncondensing, that the steam consumptions are 65 and 55 lb. per indicated horsepower-hour, respectively for the large and small hoists, and that power for the electric hoist is supplied from a modern steam-turbine station using units of 1000 kw. each, or larger for the smaller hoist, and 2500 kw. or larger for the larger hoist. In determining these ratios the power consumption has been increased 10 per cent. to cover the transmission losses.

COMPARISON OF STEAM AND ELECTRIC HOISTS

Hoisting from 2000-ft. Level, Small Hoist

	Coal Burned, Tons per Day	Ore Hoisted, Tons per Day	Tons Ore, per Ton Coal
Steam hoist	47	1780	40
Electric hoist:			
First system	13	1780	137
Second system	15	1780	119
Third	16	1780	110
Fourth system	15	1780	119

Hoisting from 6000-ft. Level, Large Hoist

Steam hoist	65.5	1580	24
Electric hoist:			
First system	23	1580	69
Second system	24	1580	66
Third system	25	1580	63
Fourth system	27	1580	59

In addition to the saving in fuel, which may be realized by the use of electric hoists, there is a material reduction in the labor, the cost of which is chargeable against the hoist. This may amount to the wages of one or two men in the boiler house, if power is developed by the mining company, or of the whole boiler-house force if power is purchased, and frequently the wages of one man in the hoist house.

So many factors enter into the cost of electric hoisting that each individual case may be analyzed separately. An approximate estimate of the power consumption would be from 1¼ to 2¼ kilowatt-hours per thousand ton-feet, the tonnage, in the case of unbalanced hoisting, including the weight of the ore and skip, while for balanced hoisting only the ore.

The production of crude platinum from placer mines in the United States comes from California and Oregon. The output in 1910, according to the U. S. Geological Survey, was 390 oz., valued at $9507, a decrease of 282 oz. compared with 1909 figures.

The Estimation of Ore Reserves

By Frank H. Probert* and Roy B. Earling†

At the Ray Central mine, development drifts are systematically driven along rectangular co-ordinates delimiting the ore in 200-ft. blocks. Cross and longitudinal sections are platted at intervals of 100 ft. Drifts are sampled by cutting a continuous groove as advance is made, each sample representing 5 ft. of the drift.

*Consulting engineer.
†Chief engineer, Ray Central Copper Mining Co., Ray, Ariz.

The following practice has been adopted at the Ray Central property, at Ray, Ariz., for estimating tonnage and value of ore developed. Inasmuch as the method can be applied at any property where disseminated ores are developed it is worthy of detailed description.

Co-ordinate System of Designating Workings

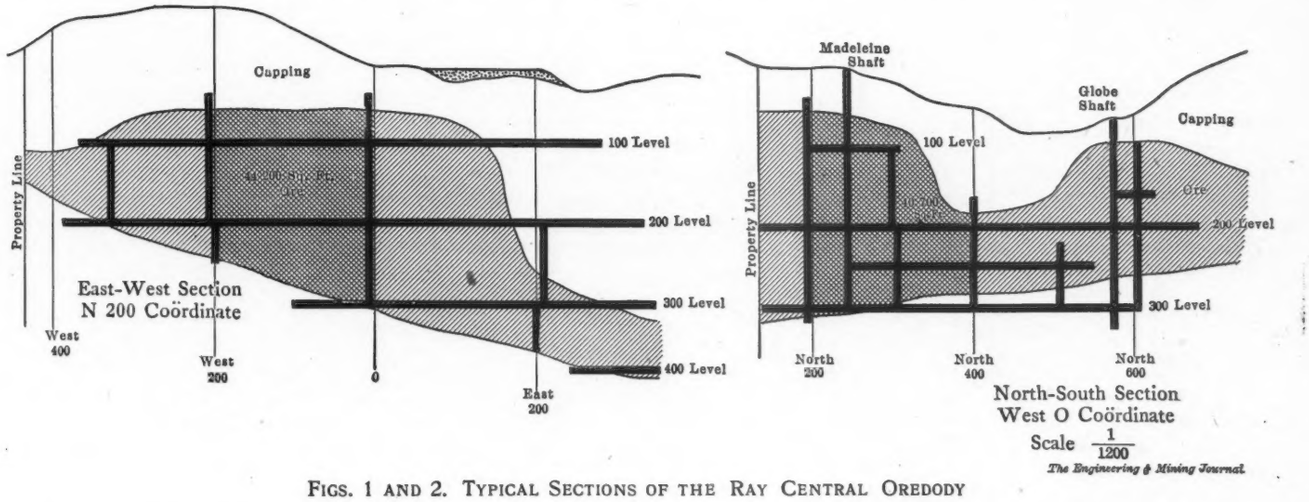
The property has been laid out and all work done along rectangular coördinates, all workings being numbered according to the distance in either direction from the zero point, for example N 400-E 600-E is a drift driven east from a point N 400 E 600. All drifts and crosscuts are run along these coördinates with winzes and raises connecting levels at points of intersection. In this way the orebody is first split into 200-ft. blocks to be later subdivided. Cross and longitudinal sections at intervals of 100 ft. and level plans are used in the computation, upon which are plotted all underground workings, churn-drill holes, assays and major geological features. The standard scale used is 50 ft. to the inch. All maps are brought up to date at the end of each month and blueprints showing progress, accompanied by the report of the engineer forwarded to the respective officers of the company.

Low-grade ores require constant and accurate sampling. The copper occurs as finely disseminated particles of chalcocite, chalcopyrite, oxide or native in a silicious schist, or occasionally in the intrusive rocks to which the orebodies owe their origin. To distinguish between commercially mineralized schist and waste is impossible except by careful sampling. All underground openings whether in ore or country rock look monotonously alike, hence the necessity for accurate sampling and assay maps.

Samples are taken in 5-ft. sections starting from a coördinate or transit point, care being taken to first clean down the walls. A continuous groove 1½ in. deep and 3 in. wide is cut in each wall. Particular care is taken to secure about the same amount of material from every part of the 5-ft. section to prevent the enrichment of the sample by any small seam of high-grade ore which might occur. About 35 lb. are taken per sample. As the drift advances the groove is continued. The samples are sacked underground, dried, crushed, quartered in split dividers and the final pulp put up in duplicate, one for permanent filing, the other for immediate assay. All determinations are made by electrolytic assay, the apparatus being of the rotating-anode type. The results are recorded on the maps and complete numerical and classified card files are kept in the fireproof vault at the mine office. To avoid the possibility of error, frequent check samples are taken in stretches of from 50 to 100 ft. The laboratory work is also checked by composites and re-assaying of individual samples.

Measurement of Tonnage

The first step in computing tonnage is to define the workable limits of the orebody on the several maps, taking each set of sections separately. Local economic conditions naturally determine the minimum grade that can be profitably mined, so that in sketching in the areas of commercial ore the limits are defined by the assays. Any marked irregularity is, of course, avoided, the object being to outline the orebody as it will be mined. A run of low-grade assays will often be included in a block while a small tongue of high-grade might have to be discarded from the calculation. If a working has been discontinued in ore, an allowance is made for the probable extension of the orebody a distance of from 5 to 50 ft., depending on the proximity of other workings, the uniformity of the ore and geological conditions. Here the personal equation of the engineer figures in the estimate and intimate knowledge of the district is necessary.



FIGS. 1 AND 2. TYPICAL SECTIONS OF THE RAY CENTRAL OREDODY

Each set of sections is compared and correlated with the other sections and plans and altered so that they represent a definite orebody of concrete form. Areas are always reduced rather than added to in making the sections conform. Figs. 1 and 2 are reductions of actual sections used in the computation recently made for the shareholders of Ray Central.

Ore Measured in 200-foot Blocks

The cubic content of the orebody is now determined by taking blocks 200 ft.

square, of variable depth, designated by the coördinates between which they lie, viz., N 200-400, W., 0-200. At Ray Central longitudinal and cross-section maps are available at intervals of 100 ft. so that in calculating any given block, six sections have to be used, three north-south and three east-west as shown in Figs. 3 and 4. These maps show the sectional area of the orebody on each face and through the middle of the block, the areas being measured either by planimeter or by counting the squares on cross-section tracing cloth superimposed on the map, and multiplying by the factor necessary to give square feet. Taking either set of three sections the volume of the block is calculated by the prismoidal formula, which is:

$$V = L\left(\frac{E + 4C + E'}{6}\right)$$

Where V is the volume, E one end area, E' the other end area, C the area of

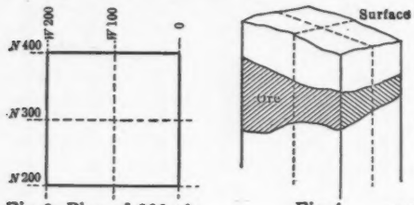


Fig. 3 Plan of 200-ft. Block

Fig. 4

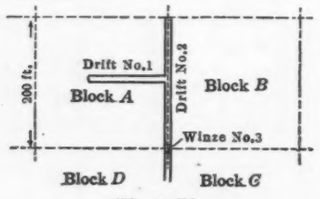


Fig. 5 Plan

The Engineering & Mining Journal

DIAGRAMS OF 200-FT. BLOCKS OF ORE

center section, and L the length. Inasmuch as there are two entirely separate sets of sections, north-south and east-west, two results are obtained for the volume of each block, which should be approximately the same. If the conditions are such that the two sets of sections should give equally correct results, the average of the two is accepted as the volume of the block. For full blocks 200 ft. square the measurement of volume is simple, but irregular fractional blocks on the edge of the orebody cannot be as accurately estimated. Where owing to the form of the block, three faces are presented by one set of sections and only one or two by the other set, the result obtained from the first series is accepted.

Throughout the Ray District the ratio of 12½:1 is used in the conversion of volume to tonnage. The total tonnage is obtained by adding together the tonnages of the individual 200-ft. blocks.

CALCULATION OF AVERAGE GRADE

The average grade of the orebody thus delimited is determined by the average assay values of the individual blocks. In a block containing both high- and low-grade ore, irregularly distributed, it is obvious that an arithmetical average of all assays in such block would be incorrect. Due weight must be given to each run of assays according to the number of times it figures in the computation.

Referring to Fig. 5, if all assays were given the same weight in computing the value of block *A*, and subsequently the assays in block *B* were averaged to give the value of that block, then the assays in drift No. 2, which is on their common line, would be used twice, while those in drift No. 1 would be used only once. In the same way after all adjacent blocks had been figured the assays in winze No. 3 would have been used four times. In other words the assays in workings along coördinates would have twice the representation and those in the winzes and raises at the intersection of coördinates, four times that of the interior workings and unless this is guarded against the results cannot be accurate.

DATE Jan. 1, 1911 CLASS Actual
ENGR. ..... BLOCK N 200-400 W 0-200

E-W SEC.

Section		Area in Square Feet	Total
N200	33,500x4	44,200	
300		134,000	
400		14,200	

$$192{,}400 \times \frac{200}{6} = 6{,}412{,}000$$

N-S SEC.

W 0	32,000x4	40,700	
100		128,000	
200		20,700	

$$189{,}400 \times \frac{200}{6} = 6{,}313{,}000$$

ACCEPTED (ave.) 6,362,000 cu.ft.
509,000 tons

ASSAYS

Map	No.	Total	Factor	No.	Total
100′ lev....	73	146.72	1	73	146.72
200′ lev....	63	127.24	2	126	254.48
	115	244.09	1	115	244.09
250′ lev....	54	103.17	1	54	103.17
300′ lev....	22	46.67	1	22	46.67
Sections...	103	217.78	½	51½	108.89
...	46	116.07	1	46	116.07
...	12	26.24	2	24	52.48
TOTAL				511½	1027.57

AVERAGE ASSAY 2.098 per cent.

FIGURE 6

It is, therefore, necessary in order that each assay have the same representation in the final result that they be given different factors in individual blocks, as follows:

All assays in interior of a block, a factor of 4
All assays on side faces of a block, a factor of 2
All assays at corners of a block, a factor of 1

In estimating the value of the Ray Central orebody the ratio of ½, 1 and 2 is used, instead of 1, 2 and 4 to facilitate the work, viz., 46 assays in drifts along a coördinate line totaling 116.07 are figured as such, whereas 103 samples giving 217.78 from winzes at the corner of a block figure as 51½ samples of 108.89, so that in the block shown, instead of having 488 samples totaling 1027.98, we figure 511½ samples giving an assay total of 1027.57 making the average assay for the block 2.098 per cent.

The general assay of the whole orebody is obtained by adding the "tons per cent." of component blocks and dividing by the total tonnage. Summarized the estimation involves:

(1) Computation of tonnage for individual 200-ft. blocks by prismoidal formula.

(2) Computation of average assay for individual blocks with assay factors according to situation.

(3) Computation of total tonnage by addition of block tonnages.

(4) Computation of general average assay, using factors for block averages according to tonnages.

All block tonnages, assays and computations are kept in a loose-leaf book on special forms, Fig. 6, provided for the purpose.

Grecian Emery

The emery deposits of the Grecian archipelago, according to M. Papavasiliou,[1] are associated with massive deposits of limestone and dolomite, which constitute the principal islands. Three workable zones are distinguishable, of which the lowermost is the most productive, being extensively operated at Naxos. A great number of interstratified lentils here cover an area of about six square kilometers. Some of these are traceable with an average thickness of 10m. for a distance of one kilometer.

The emery of Naxos is very pure, and occurs in a compact granulated mass, in which the crystallized alumina is mingled with magnetite and a little hematite. The more impure varieties display a banded structure, comprising tourmaline, margarite, muscovite and calcite. More rarely are found gray veins of corundum, or blue veins of sapphire, together with quartz and sillimanite. These pass by gradations into emery-bearing limestones and mica schists. The author explains the origin of the emery on the basis of massive dikes of pegmatite, which are, in turn, related to intrusions of granite.

The emery deposits of the two upper zones, developed only on Iraklia and Sikinos, are similar in character, but are more finely granulated and are associated with more finely crystallized limestones. That of the highest zone is contaminated by a larger percentage of iron oxide, and also contains margarite and chlorite. Many of these inferior deposits would be commercially valuable, but the Grecian government imposes an export tax on all private enterprises in order to maintain its monopoly of the superior grades mined on Naxos.

[1]Abstract of a paper read before Société de l'Industrie Minérale, at Düsseldorf.

The Permian Copper Ores in Texas

By William B. Phillips*

The Permian copper ores of Texas are small pockety deposits. It is proposed to treat them by washing the entire mass in a log washer.

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At the risk of rehashing more or less of the data that has been accumulated concerning the Permian copper ores of Texas during the last 30 years, I propose to discuss them briefly from a new standpoint, viz, that of the brown-ore miner.

These ores are found in the counties of Hardeman, Wilbarger, Knox, Baylor, Archer, Haskell, King and Stonewall, northwest and west of Fort Worth, a region penetrated by five railroads.

Classification of Ores

For convenience of classification these ores may be considered under three main groups: (1) Mixed carbonates and sulphides, which are for the most part replacements of woody fiber. (2) Banded carbonates, which are composed of thin layers of carbonate of copper in a loose, friable clay. (3) Copper sulphides, mostly chalcocite, with a little pyrite.

I do not consider that any of these ores can be profitably mined and treated, except by the methods now employed in mining and treating the brown-iron ores of Alabama, Georgia, Tennessee, Virginia, etc., i.e., by mining the entire mass by pick and shovel or steam shovel, and washing it in an ordinary logwasher or similar machine, to free the ore from adhering earth, clay, sand, etc. If this view of the matter is correct, class 2 is excluded from further consideration. The banded carbonates, consisting of thin layers of carbonate of copper in a loose, friable clay are beyond hope of profitable concentration. The carbonate is itself extremely friable, and when it is mixed with water it goes off as slimes. This class of ore seldom carries more than 3 per cent. of copper, an amount attractive enough if there were hope of profitable concentration applicable to large bodies of cheaply mined material. But these conditions do not exist.

Cost of Acid Prohibits Leaching

Nor do I believe it commercially possible to leach this class of ore with acid for the production of cement copper. The cost of the acid in this part of Texas would prevent the profitable application of this method of treatment. A not inconsiderable proportion of class 1, mixed carbonates and sulphides, for the most part replacement of woody fiber, is closely associated with class 2, so that there would be a serious loss of the copper contents of this ore in the washer. So much of class 1 as is represented by the friable carbonate would follow the waste water. The determination of the value of any deposit of class 1 would depend upon the proportion of class 2, which is present, for only the harder pieces could be saved. These pieces are chiefly pseudomorphs after wood, are generally flat and from one-fourth inch to one inch thick. At their best they carry up to 10 per cent. in copper.

The best ore in the entire region is class 3, a hard, nodular chalcocite, carrying from 55 to 60 per cent. of copper. It occurs as pockets in blue and red clay, and is easily washed. The individual pieces vary in size from one-fourth inch to two inches and even three inches. In respect to its occurrence, it is closely similar to the well known brown-ore deposits of the South, with the important exception that it seldom occurs in large masses, or "donnick."

Its occurrence as separate nodules has given rise to the local expression "potato hills," applied in some parts of the district. These "potato hills" sometimes yield several tons of high-grade ore with but little trouble. In 1874 about four or five lots of this ore were sent to the Schuylkill Copper Works and assayed by Dr. F. A. Genth. The total amount exceeded 10,000 lb., and the metallic copper varied from 57.59 per cent. to 62.30 per cent.[1]

Water and Ore Both Unknown Quantities

This was 37 years ago, but we do not know much more about the commercial situation now than we did then.

The question as to how much workable ore is to be obtained in any one locality, or within hauling distance of a central washing plant, is still unsettled.

There has been no study of the region with reference to the one vital point, viz, the yield of workable ore per cubic yard of material. Until this is done it is almost useless to consider the matter from a practical standpoint. So closely connected with this as to be inseparable from it is the question of water supply for washing operations. If there is no sufficient supply of water for washing, the question of the utilization of these ores is merely academic. Under ordinary conditions we may assume that there will be needed not less than 500 gal. of wash water per ton of ore yielded by the washer. If the clays are tenacious, this amount may easily rise to 750 gal., and perhaps more. For washing 100 tons of ore there will be required 50,000 gal. of water in the washer alone, to say nothing of the consumption in boilers and in the camp. There is not a great deal of available water in this general region, so that this feature of the business would demand careful attention. The impounding of the tail water could, of course, be accomplished and a certain proportion of it used again. As an offset to this, it must be remembered that the evaporation in that region is high, from 25 to 50 per cent.

The actual power for driving the machinery, shovels, washer, inclined hoists, tram road, etc., could be derived from gas engines operating electric generators, the gas being obtained from producers. But the saving in boiler water, in this direction, would not cut much figure as against the large quantity of water required by the washer.

The exact nature of the clays holding these ores, with respect to their easy removal by water, has not been investigated. This is an important consideration, for upon it will depend, in large measure, the consumption of water in the washer. If the clays are of such nature as to be easily suspended in water, leaving the ore clean, if they do not "ball" and thus carry away some of the fine ore, the consumption of water is considerably less than if they are tenacious and more or less like putty.

Furthermore, it is not yet known what proportion of the ore is in a more or less finely divided condition, passing an eight-mesh screen, and, therefore, requiring accessory jigs. It is doubtless the case that different localities will show marked variations in this particular, as has often been observed in brown iron-ore regions.

Early Smelting Failure

The failure of the plan to utilize the Permian copper ores about 1884 can not reasonably be held against them. That failure was due to an almost complete misapprehension of their nature, in the first place, and to the entire lack of transportation facilities in the second. At that time machinery, supplies, etc., had to be teamed for more than 100 miles. There was but one railroad anywhere within reach, and this did not penetrate the best part of the territory involved.

[1]Texas Geol. Surv., second annual report, 1890, p. 450.

The attempt was made to smelt a class of ore that could not be utilized in this way, for there was but little of class 3 available. The low-grade carbonates were used and failure was inevitable. To haul coke by wagon more than 100 miles and undertake to smelt what was little better than a copper-stained clay certainly did not hold out much promise of success.

Now, however, the economic situation is of quite a different sort. The region is traversed by four railroads, two of them, the Fort Worth & Denver and the Kansas City, Mexico & Orient, running to well established smelting centers, i.e. Denver and Kansas City.

The fuel situation has also changed, with the bringing in of the oil and gas wells in Clay and Wichita counties. It would now be feasible to assemble these ores at some point within easy reach of fuel oil and natural gas and convert them into copper matte.

At Wichita Falls, reached by four railroads, natural gas can be obtained for manufacturing purposes, at less than 5c per 1000 cu.ft. There will soon be laid an oil-pipe line to this flourishing town from the nearby oilfields, in which there is now much activity.

The Electra oilfield, Wichita county, is now the largest producer in Texas, its total yield of 7000 bbl. a day putting it somewhat in the lead of the Humble field, north of Houston. There is no technical or economic reason why the cheap fuel now to be obtained within easy distances of some of the best known copper deposits in that part of the State should not be employed in developing them.

Conclusion

In the study of these deposits, from a practical standpoint, there are five main considerations to be held in mind: (1) The copper ores, so far known, do not occur in veins, but as pockets of greater or lesser extent in clay. (2) These deposits have but little in common with the Permian ores mined at Mansfeld, Germany, and can not be mined or treated in the same way. (3) They will have to be mined and treated as the brown-iron ores of Alabama, Georgia, etc., are mined and treated, i.e., by sending the entire mass to a log washer or similar contrivance for the removal of adhering clay and sand. This will necessitate the location of a washing plant near some permanent source of water supply. It will also require that such a plant shall be within easy hauling distance of deposits sufficiently extensive and valuable to warrant the erection and operation of the plant. (4) The determination of the question whether the washed ore should be shipped to copper smelters as such, or converted into copper matte before shipment. (5) The exploitation of the more complex ores, carrying lead and zinc, which have been found in at least one locality, at a depth of 75 to 80 ft. below the usual ores. This is a new discovery, and is worth following up.

Handling Concrete at Salmon River Dam

In a recent issue of the JOURNAL was given an account of the methods employed in handling concrete in the construction of the new Belmont mill. The following description of a big irrigation dam on the Salmon river in southern Idaho, completed Jan. 1, 1911, should be of interest as showing somewhat different construction methods. The dam referred to contains 150,000 cu.yd. of masonry and will hold the water supply of 100,000 acres of land near the boundary between Idaho and Nevada. The reservoir formed by the dam will have a maximum area of 3500 acres, while its storage capacity is 228,000 acre-feet. This gives some idea of the size of the project.

The preliminary work was begun in the spring of 1908, when 100 men were set to work. In the spring of 1909 the excavation for the foundation was commenced and the working force was increased to 200 men. About June 1, 1909, when the concreting was begun, the force numbered 300 men and in 1910 when the work was at its hight, 430 men were employed.

Such work as this naturally demanded modern equipment and every care was taken by the engineers in charge to see that labor- and time-saving equipment was at hand. A complete system of skips, portable tracks with cars, switches, etc., was furnished by the Orenstein-Arthur Koppel Company. This equipment included cars of several different types, each adapted to handle most expeditiously the class of material for which it was designed.

Central Mixing Plant

A central concrete-mixing plant was erected directly back of the east rim of the cañon and a short distance down stream from that end of the top of the dam. This plant was in three units, each consisting of a rock crusher, a bucket elevator, a revolving screen and a one-yard mixer. Each crusher was belt driven by a 40-h.p. induction motor which also operated the elevators and screens of each unit. The rolls and the bucket elevator that handled their output were driven by a 20-h.p. motor of the same type. Each mixer was separately belt driven by a 30-h.p. induction motor in a tight shed to protect it from dust.

A counterbalanced double-cage hoist, inclined at an angle of 14 deg. from the vertical, was erected on the side of the cañon adjacent to the mixing plant to lower the cars of concrete to the level of tracks on trestles extending across the cañon, at the elevation at which the operations were in progress on the dam. This elevator was built with a landing platform at the top, arranged with automatic blocks so a car on either track could not be pushed until the corresponding cage had reached the exact level of the track. The two cages were each 6x8 ft. in plan, having a capacity of five tons. They were arranged so that when one descended loaded it pulled the other up empty. In order to provide for unbalanced loads, however, a hoist on the elevator was geared to a 40-h.p. motor.

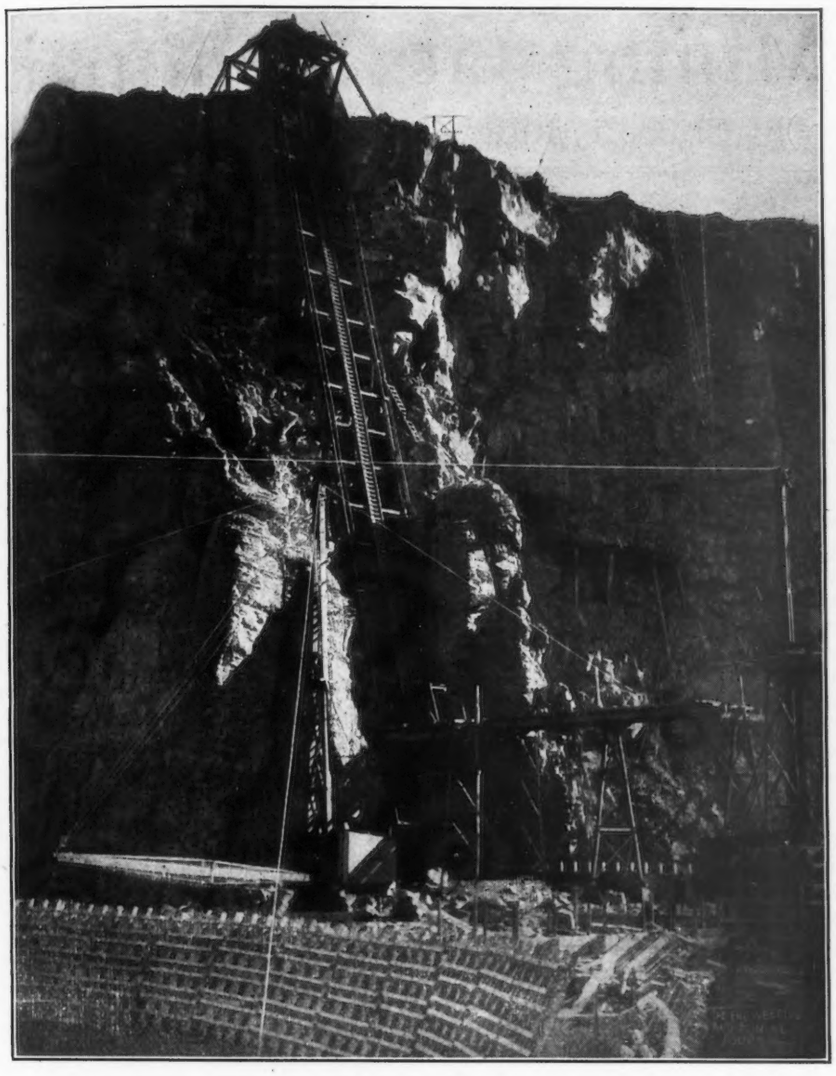
The sand was brought in wagons from a deposit up the river to storage piles near the concrete plant. The spoil from the rock cut made in excavating a canal between the two outlet tunnels was loaded into cars by traveling stiff-leg derricks and hauled directly to the crushers by electric mine locomotives supplied with power from an overhead trolley. The track at the rear of the concrete plant was on a trestle, permitting the rock to be dumped from the cars directly into the crushers. The output of the crushers was raised to the corresponding screen at the top of the plant by the bucket elevator of the unit. The fines from the screen were shunted to rolls to further reduce them. The output of the rolls was raised by a separate elevator to a sand bin at the top of the plant. The oversize from the screen fell into a second elevated bin provided for the stone supply. The natural sand also was sent to the crushers and raised to the bin provided for it. The cement was delivered by traction-engine trains to a storehouse adjacent to the mixing plant. The cement, as required at the mixer plant, was loaded into cars and hauled up an incline by a motor-driven hoist to the measuring floor over the mixer.

The materials were proportioned in a hopper over each of the mixers, the sand and stone being drawn to these hoppers through chutes in the respective bins, while the cement was added to each batch by hand. The concrete was discharged from the mixers into steel dump cars, or into buckets on flat cars, and distributed over a 30-in. gage track to the point desired.

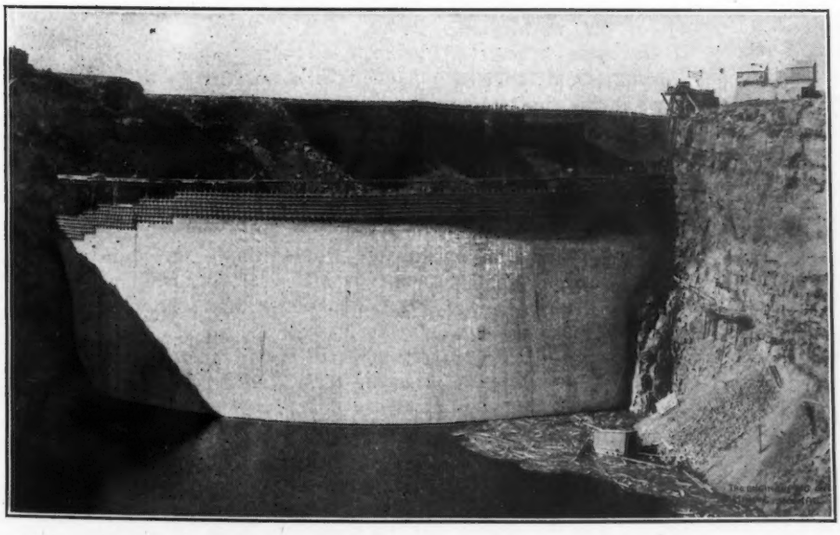
The canal between the two outlet tunnels involved the removal of approximately 86,000 cu.yd. of ground, all of which had to be blasted. The rock was loaded by hand into skips which were hoisted by two traveling stiff-leg derricks and dumped directly into 2.5-yd. steel cars for delivery to the concrete plant. A 30-in. gage track was laid along the edge of the excavation for the derricks, which were moved by their own power.

Placing the Concrete

Placing of the concrete was started at the west end of the dam as soon as the



INCLINED HOIST AND TRESTLE FOR DELIVERING CONCRETE AT SALMON RIVER DAM



CONCRETE IRRIGATION DAM ON SALMON RIVER, IDAHO, NEARING COMPLETION. THE DAM HOLDS WATER STORAGE FOR 100,000 ACRES

foundation at that end had been prepared. A jaw crusher with three storage bins and a ½-yd. concrete mixer were erected just upstream from the excavation. A large pile of spoil from the outlet tunnel had accumulated at this point, where it could be passed through the temporary concrete plant by gravity. The concrete produced by the mixer was delivered in the cars on tracks laid across the channel to within the range of the derricks at the west end of the dam. It was dumped directly to place from the cars when the latter were swung around by the derrick.

Meanwhile a trestle was erected across the cañon, on the axis of the dam, bringing it to a hight of 27 ft. above the lowest point of the bedrock foundation. A single track on this trestle extended from two branches at the foot of the inclined elevator across to the opposite side of the dam. Early in the work the concrete was delivered in one-yard buckets, which were lowered into the cañon on flat cars by the hoist and then shunted over the trestle track to within the range of the derricks. Later the one-yard steel dump cars were used, hoppers being swung from the side of the trestle to carry chutes through which the concrete could be dropped from them directly to place. The chutes were made of 12-in. galvanized pipe in short sections, telescoping, so their lengths could be altered according to the hight of work. The chutes were also sufficiently flexible to permit their lower ends to move through a considerable range.

United States Oil Production in 1910

More than 200,000,000 bbl. of oil, with a value of nearly $128,000,000, were produced in the United States last year, according to David T. Day, of the U. S. Geological Survey. The United States is now by far the greatest oil-producing country. In 1910, the wells of this country yielded nearly 64 per cent. of the world's production, Russia coming second with about 21 per cent. The production of other countries is comparatively negligible, the third on the list, Galicia, contributing only 3.87 per cent. of the total.

There are now 148,440 oil wells in operation in the United States. Over 8,500,000 acres of land are leased for oil and 700,000 acres are owned in fee by oil operators.

California heads the list of producers in 1910 with 73,010,560 bbl., an increase of 17,538,959 bbl. over 1909. Oklahoma was second, with a production of 52,028,-718 bbl., and Illinois, third, with 33,143,-632 bbl. Louisiana, while eighth in the list, shows an increase in production over 1909 of 123 per cent., as a result of the development of the new gushers in the Caddo field.

Notes on Mining at Tonopah

By Claude T. Rice

Both wide and narrow veins are mined. Air-hammer drills are generally used in stoping; drifting done with one-man piston drills. At the Montana-Tonopah mining is done on waste filling.

Mining at Tonopah, Nev., presents several interesting features, but difficulties in underground stoping are not especially great except at the Montana-Tonopah property. While Tonopah and Goldfield are comparatively but a few miles apart, conditions as regard the labor situation are vastly different at the two camps. During the trouble with the Western Federation of Miners at Goldfield, the miners at Tonopah remained at work, at a lower wage scale, and no trouble was experienced. Conditions affecting the situation date back to the origin of both camps.

The Labor Situation

Comparatively, Tonopah has always been a law-abiding community; in contrast to this, Goldfield in 1906, 1907 and 1908 was a central point of gathering for turbulent characters of all descriptions. The operators at that time were satisfied to get the ore out in any fashion that would comply with the terms of the leases under which they were working. They were anxious to get the last possible pound of ore out before the lease expired and in so doing permitted their miners to take what they considered a reasonable rake-off. In view of these conditions it was not surprising that the miners became infused with the prevailing lawlessness in the community and tried to continue in this way after the mining men wished to reform. The opportunity to thieve at Goldfield brought about these conditions regardless of the fact that the union existed there.

On the other hand, the miners at Tonopah entered the mines to earn their living, not to steal. The companies explored and developed their properties instead of leaving the work to irresponsible individuals, as at Goldfield. The conditions at Goldfield attracted the riff-raff that early congregated at Tonopah, much to the benefit of the latter camp. Almost from the beginning there has existed a local of the Western Federation of Miners at Tonopah; but there has never been any trouble since the day when Jim Butler, upon hiring his first man, voluntarily raised the wage to $4 for an 8-hour shift. It was the richness of the ore that was found at Goldfield, as much as anything else, that caused the conditions that existed there.

Ore Occurrence

The ore averages about $15 per ton, about one-third in gold and two-thirds in silver. This figure is for ore as mined, as after the ore has been sorted and treated the grade, as reported by the companies, is considerably higher. While the ore has been formed along fissures, much waste is found along with the ore, as all the breccia has not been mineralized. Most of the veins have a low dip, and some of the deposits along the contact are comparatively flat. The veins have been broken by faults of small displacements, but these have not greatly affected stoping costs, except at the Montana-Tonopah. They have, however, rendered stoping less systematic and have greatly increased the difficulty of mining.

Wall Rock Stands Well

The wall rock, usually andesite, stands remarkably well, being quite dry. Moisture bears an important relation to the standing quality of a rock in a desert country; it hastens the decomposition of the minerals and has a tendency to act as a lubricant, the latter aiding greatly in causing the rock to move, in stoping operations. The strength of the wall rock is well shown in the contact workings of the West End mine, where areas 100 ft. wide on the strike and from 50 to 75 ft. on the dip stand for quite a period with only an occasional stull. In the regular fissures the strength of the country rock is illustrated by the fact that second stopes have paralleled old worked-out, unfilled stopes, 30 ft. wide in places, the only supports being from splicing new stulls to old ones in the first stope. Only in the Montana-Tonopah is it necessary to fill the openings as fast as mining progresses; in that mine it is necessary to keep the stope well filled. This filling is partly necessitated by the fact that subsequent prospecting may show orebodies nearby, thrown there by faults.

Waste Hoisted in Early Days

In most of the Tonopah mines, especially in the workings of the Tonopah Mining Company, the weight does not come on the stopes until long after they have been abandoned; at present stopes worked early in the life of the camp are just beginning to collapse. When the mines were first opened it was the custom to hoist all waste to the surface; however, the filling of these older stopes is now urgent, and consequently the present stopes have to wait upon the filling of the older ones before waste from developments can be dumped into them. The old practice of hoisting the waste was not bad practice at the start. The mistake was made in continuing it too long. Until the wall rock has been thoroughly prospected it is unsafe to fill the stope. In the early history of most mines prospecting is usually done where it is thought that it will show the most ore, and that generally is not considered to be in the walls of the stope. This was true at the mines of the Tonopah company, and the ore was hoisted to surface rather than used to fill the stope before the characteristics of the ore occurrence were thoroughly understood.

Mining Methods

In general, few stulls are used in the Tonopah mines, but in the wider stopes, square sets are being employed. The practice is not to fill the sets as mining progresses, but to wait until stoping is well along. This is all right, but full advantage is not taken of the natural conditions, as more extensive use could be made of slides in getting the ore out of the square-set stopes, and little shoveling should be necessary. The posts of the square sets used at the Tonopah Mining Company's mines are too short, as there should be a clearance of at least 6 ft. 8 in. between floors in order to operate with the greatest economy. In the Tonopah-Belmont workings, peculiar sizes for the different members of the sets are used, 10x10-in. timbers being employed for caps, while the girts are cut from 8x10-in. stuff. In the sets where the tracks run, double-length caps are used at the Belmont.

In flat stopes that are under 12 ft. wide, necessitating only two stulls, most of the ore is "bulldozed" out of the stope by main strength with shovels and in a manner that should hardly be called mining. Sheet-iron chutes are used in the flat stopes of the Tonopah company, and at first, following South African practice, these were suspended by chains hung from the roofs, the chutes being swung by hand. It was later found that the ore would run in the chutes at an angle as low as 25 deg. without swinging, after which the chutes were laid on the floor of the stope. These chutes are made of ⅛-in. sheet iron in a semicircular form with a diameter of 30 in., and are 8 ft. long, being reinforced by 2½x2½-in. scrap iron, riveted near both ends. In these stopes the chutes are laid to overlap one another, and carry the ore to a small pocket at the bottom of the stope. In some of the stopes the Tonopah company uses the ore-filled method until the width exceeds 12 ft., when the square-set method is used.

Mining on Waste Filling

At the Montana-Tonopah mining is done on waste filling. This is the most interesting stoping in the camp and caused the mine to look the most shipshape of any that I saw when at Tonopah. At this mine the ore is sorted fairy well in the stope, the rest of the waste for filling being obtained from inclined raises that are put up in the walls to prospect for nearby orebodies, as well as to furnish waste for filling the veins, which are from 3 to 8 ft. wide. A series of slightly dipping step faults break up the walls, making it imperative to fill the opening as the stope progresses. These faults, taken together with another series of steeply dipping faults, so break up the vein that it is entirely out of the question to raise to the level above and obtain the excess waste required in the stope from development work carried on upon the different levels. In addition the walls must be prospected closely between levels, as well as on the level. due to the dip faults.

Methods in Narrow Veins

Where the vein is narrow the waste is blasted down first, leveled off and the ore blasted down afterward. A good method employed at the Montana-Tonopah mine is that of having the machine miners drill the holes in the roof and leaving them for the muckers to blast; this is made possible at the Montana property, as the ore occurs as a number of stringers through a mass of waste. The shovelers, mainly single-jack miners waiting for a place on a machine, understand the use of dynamite better than do the machine-trained miners, and therefore blast the holes more lightly, breaking the rock into larger pieces, thus enabling most of the bands of waste between the ore stringers to be rapidly sorted. Knowing that it is easier to sort coarse ore than fine, the shovelers realize that they can make a better showing with the coarse and so make better men for blasting. At the Montana-Tonopah it has been found possible with this method to mine at a profit ore that would hardly pay were it used from wall to wall. Small chutes cribbed with 2-in. planks are used. In lagging the stulls above the level for carrying the ore in these stopes, 3-in. planks are used instead of 8-in. poles, as is the practice at the ore-filled stopes of the Tonopah company. This is cheaper and the planks are cut so as to fit tightly against the wall.

Day Work at Tonopah Mining

An interesting thing about the mining at the properties of the Tonopah Mining Company is the arranging of the work so that as much as possible can be done on day shifts. This permits most of the men to get a good night's sleep and at the same time the load on the machinery is kept well balanced, as is obligatory when operating with purchased electric power. All drilling in the stopes, as well as the mucking in development workings, is done on day shift; the drilling in the development faces and the tramming and hoisting of the ore are done on night shift. The blasting is all done on night shift by a special crew of three men, each loading and blasting on an average about 125 holes in the 8-hour shift. This permits the drillers to run the machines up to quitting time and by the use of a trained crew of men for blasting a considerable reduction has been made in the cost of explosives. In addition, better air is secured for the miners, as the blasting is done first in the poorly ventilated places.

MONTANA-TONOPAH MINING COSTS

	Per ton
Labor:	
Ore breaking	$0.844
Timbering	0.211
Hoisting and dumping	0.254
Blacksmithing	0.038
Surveying	0.039
Foreman and shiftbosses	0.075
Sampling	0.019
Assaying	0.027
Sorting and shoveling	0.618
Tramming	0.337
Watchmen	0.014
Storekeeper	0.011
	$2.487
Supplies:	
Ore breaking	$0.392
Compressed air	0.108
Timbering	0.201
Hoisting and dumping	0.084
Hoisting—electrical power	0.125
	$0.910
	$3.397

Method of Drilling

Waugh air-hammer drills are used almost universally throughout the district for stoping, although a few Shaw drills are employed in some of the mines. With the air-hammer drill a miner in a stope can put up from 12 to 18 holes, averaging 5 ft. in depth. Drifting is done with one-man piston machines and with one drill in a face. A clean face is always left for the machine men at the Tonopah company's mines, thus permitting better progress to be made, and the work of drifting is made easier by blasting on turn sheets and using square-point shovels in the drifts. Since the company has been using these sheets a shoveler can muck out a round, 10 to 15 tons of broken rock, in from 4½ to 5 hours, depending on the length of the tram; he can then use the remainder of the shift to shovel ore in the stopes that has not been blasted into the chutes.

MONTANA-TONOPAH DEVELOPMENT COSTS

	Per ton
Labor:	
Breaking	$0.650
Timbering	0.087
Hoisting and dumping	0.118
Foreman and shiftbosses	0.047
Tool sharpening, etc.	0.026
Tramming and mucking	0.300
Surveying	0.019
Watchmen	0.008
Storekeeper	0.005
	$1.260
Supplies:	
Breaking	$0.348
Compressed air	0.084
Timbering	0.045
Hoisting and dumping	0.035
Hoisting—power	0.064
	$0.576
	$1.836

A noteworthy feature of the mining practice at Tonopah is the large amount of sorting that is done on the surface. This is made possible by the great quantity of waste that occurs, and owing to the wide difference in appearance between the waste and the ore, rapid and efficient sorting can be done.

Costs

The development costs at the Montana-Tonopah are typical of the district. The raises are two compartments, the drifts 6x7 ft., and the company uses a 1½-compartment shaft, characteristic of the mines that have been found by prospecting under the andesite capping. The cost of these three classes of work, exclusive of compressed air and general charges, was $6.24 per ft. for drifting, $5.83 for crosscutting, $5.10 for raising and $14.43 for sinking. Approximately one-fifth foot of drifting and crosscutting was done per ton of ore mined in the period under discussion, and 42 per cent. of this work found ore. The cost of mining was $3.40, development, $1.83, making a total cost of $5.23 per ton. An accompanying table shows the itemized costs at the Montana-Tonopah. The cost of mining at the mines of the Tonopah Mining Company is $3.95 per ton, while that at the Tonopah Extension is $3.11.

Potash from Feldspars

Special Correspondence

Chemists in Denver and New York are working on the problem of extracting commercially the potash from leucite, vast flows of which exist in Wyoming. The theoretical composition of leucite is $KAl(SiO_3)_2$. It is expected that 9 to 10 per cent. of potash can be realized from it. The problem of extracting potash commercially from potash feldspar is also being revived and it is probable that expert investigation will be made. The theoretical potash content of orthoclase and microcline, those feldspars containing the largest amount of potash is 16.9 per cent., and there are large deposits in Canada and in the eastern United States that run on an average of more than 10 per cent. potash. The leucite source offers some special interest because of the vast surface extent of the rock deposits and because it is hoped that some phosphorus may also come from the apatite therein.

In this same connection an investigation of the whole American field for potash deposits is now being made. So far the only encouragement reported is from Arizona and Nevada. Three potash areas are known in Mexico, one of which, recently discovered, is considered promising.

The Braden Copper Company—II

By Pope Yeatman*

This company will treat a 2.85 per cent. ore by wet concentration followed by blast-furnace smelting and basic converting, and will experiment with a leaching process. Estimated output, 36,100,000 lb. yearly.

*Consulting engineer, 165 Broadway, New York.

NOTE—Abstract of annual report by the consulting engineer.

From a close study of the Braden ore and from experience in the treatment of somewhat similar ore in Nevada and Utah we have made plans for a concentrator, and the plant is now under construction. It is designed on lines somewhat similar to the Utah and Nevada plants, but with coarser preliminary crushing and with the introduction of jigs to catch the coarse mineral. The plant is designed for crushing with gyratory crushers and rolls, screening by means of shaking screens; treating the product on roughing and cleaning jigs of the Woodbury type, regrinding the tailings in chilean mills, classifying the finer sizes and treating them on Wilfley tables and Frue vanners. The concentrates will be delivered to either the smeltery, or should leaching of the concentrates be decided on, to the roasting plant.

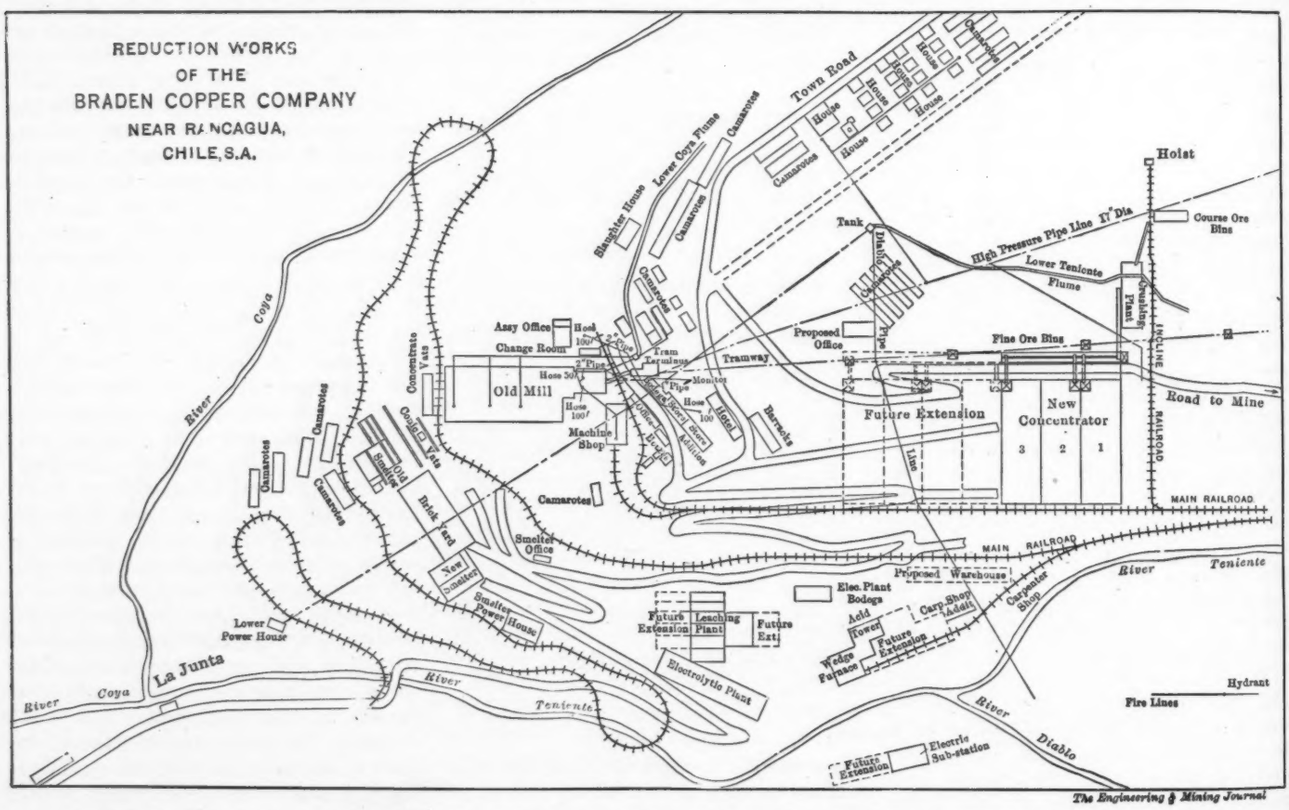
The coarse-ore bins will have a capacity of about 1400 tons. From the bins the ore will be carried on belts to the crushers, of which there will be two No. 7½ gyratories, two 48-in. rolls and six rolls of 36-in. diameter by 15-in. face. From the crusher station the ore will be delivered by belts to the fine-ore bins, about 4000 tons capacity, and from these belts to the mill itself. The concentration will be done in two separate mills, the first of three units, each unit having a nominal daily capacity of 533 tons.

The second concentrator represents an enlargement and redesign of the present concentrator. It will have a nominal daily capacity of 400 tons. These two mills will be brought up to a daily capacity of 3000 tons. The mill has been designed so as to allow for expansion at either end if plant is increased. All power used will be electric, generated from the Cachapoal ditch and power plant. The water supply for operating the concentrating machinery comes from ditches taken from the Coya and Teniente creeks, at an elevation much above the mill site. In the past flumes supplied water for milling and also for power, but the volume is not sufficient for the increased installation and hence the necessity for the new power plant.

It is confidently expected that an extraction in the mill of better than 65 per cent. will finally be obtained, and this in spite of the fact that the extraction in the old mill was much below that amount, partly due to a less favorable design, to overcrowding of the different machines, to uneven feed, to poor classification, to a variable amount of oxide, carbonates and silicates of copper and possibly to an attempt to make too clean a concentrate, and by so doing increasing the losses. The redesigned mill has been put into operation.

First Unit of Concentrator Ready

Of the new three-unit plant, the first unit is finished and almost ready for operation, and the foundations, buildings, etc., for the other two are completed. The coarse-ore bins and the crusher station, all but the erection of a few rolls and one-half the fine-ore bins, are finished. All the material is now on the ground for the completion of the entire plant. While the old mill is supplied with crushing machinery, the main crushing plant will eventually do the entire crushing. The ratio of concentration will be about nine into one. The average analysis of concentrates will be approximately: SiO_2, 24 per cent.; Al_2O_3, 12; Fe, 19; CaO, 2; S, 22; Cu, 16 per cent.



Blast Furnaces with Basic Converters

Smelting operations have been carried on to a limited extent and have proved that the concentrates can be easily smelted at a reasonable cost. This smelting was done under unfavorable conditions, both as to the size of the furnace and design. A plant has been designed, consisting of a blast furnace, 44x180 in. at the tuyeres, with a 7-ft. ore column, and a Peirce-Smith basic-lined converter for converting matte into blister. The building allows for two blast furnaces, both of which can be larger than the one mentioned, and also for an additional converter. The smeltery power plant consists of Nordberg blowing engine large enough for two converters and a No. 7 and a No. 9 Connersville blower for the blast furnaces.

Experiments made during the last year have proved, with converter slag returned to the blast furnace, the concentrates to be almost self-fluxing and requiring but little lime as a flux. The alumina in the concentrates is mainly combined with silica in feldspars and acts as a base, making a fusible slag. A briquetting plant is under construction, so that concentrates will be bricked before charging.

The plant is so designed as to allow for increase in capacity should it be so desired. Office buildings, assay office, machine shop, carpenter shop, hotel, quarters for the officials and married foreigners, and quarters for married natives have been erected. A telephone system has been put in, connecting the offices at Rancagua with the power station, concentrator and smelter, and mines, with local systems at the above-named places. There is also a separate line connecting the power plant and substation,, and there will also be a separate line for the railroad.

It has been decided to put in a leaching plant, capable of treating the concentrates from one-fifth of the daily tonnage. Numerous experiments on a working scale have been made in America on concentrates from the Braden Copper Company, which have been most successful, and should the same success be obtained in Chile on a larger working scale, it is estimated that the cost of production per pound of copper will be materially reduced.

The Leaching Plant

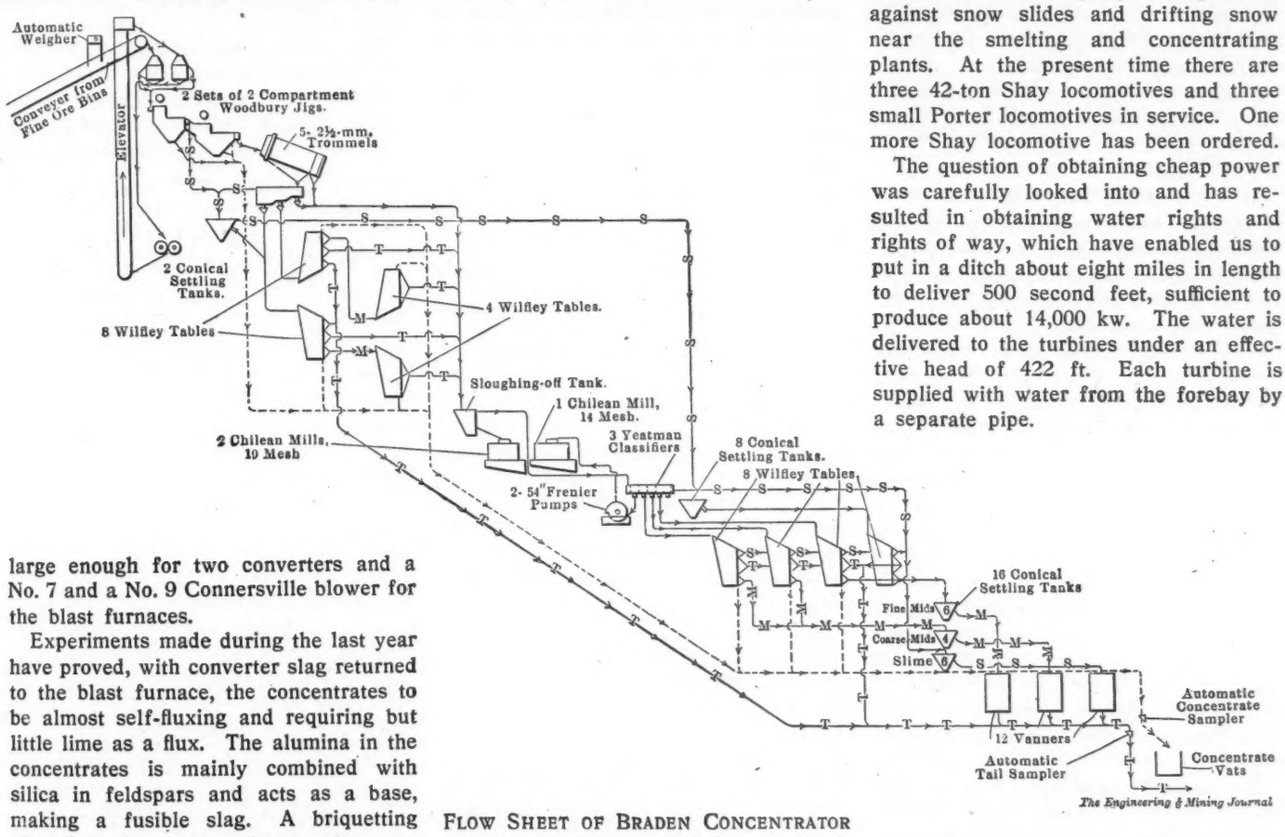
This leaching plant will consist of one Wedge furnace with acid tower and appurtenances, three leaching vats, three settling vats, nine solution tanks and a precipitation plant for 10 tons of cathode copper per day, which should leaching not be carried out, would be used for refining a certain portion of the blister copper from the smeltery. The electric precipitation plant will probably be increased, so as to handle copper either from the blast-furnace or leaching plant. What makes the method of treating the concentrates by leaching so attractive is that it is believed the costs will be lower and extraction higher; the basis for the low estimated costs is the low cost of power produced by the water-power installation on the Cachapoal.

A road of 30-in. gage has been built to connect the concentrator and smelting plant with the Central Railway of Chile at Rancagua, where the company has a freight yard, sheds, general offices, repair shops and roundhouse. The distance between Rancagua and the smeltery is 70 km., and 3 to 4 km. more to the end of the line through the smeltery, leaching plant and concentrator and shops.

Owing to the ruggedness of the country and great difference in elevation between terminals, it was necessary to put in a narrow-gage road with minimum curvature of 23 m. and maximum grades of 4 per cent. For the heavy grades locomotives of the Shay type are used, and for lighter grades, Porter engines.

Prior to the building of the road a fine wagon road had been built from Graneros to the mines, and this has been of great assistance during the first operations in preparing for the construction of the plant. While the rails have been laid and the road is in operation, there is still considerable work to do in order to ballast the road properly, and guard it against snow slides and drifting snow near the smelting and concentrating plants. At the present time there are three 42-ton Shay locomotives and three small Porter locomotives in service. One more Shay locomotive has been ordered.

The question of obtaining cheap power was carefully looked into and has resulted in obtaining water rights and rights of way, which have enabled us to put in a ditch about eight miles in length to deliver 500 second feet, sufficient to produce about 14,000 kw. The water is delivered to the turbines under an effective head of 422 ft. Each turbine is supplied with water from the forebay by a separate pipe.



Flow Sheet of Braden Concentrator

A power house has been designed and machinery purchased, sufficient to supply 6000 kw. per day. This will deliver power to the smelting plant over a line about 18 miles long, at a voltage of 33,000. From the smelting plant power will be transmitted to the mines. In the power plant are being placed three separate generators, capable of producing 2000 kw. each, with their independent water wheels and accessories.

Capitalization

The capitalization consists of $4,000,000 of 6 per cent. convertible first collateral trust gold bonds, dated June, 1, 1909, due June 1, 1919, interest payable June 1 and Dec. 1, of which all are outstanding; $2,000,000 of 7 per cent.

convertible second lien collateral trust gold bonds, dated Nov. 1, 1910, due Nov. 1, 1915, interest payable May 1 and Nov. 1, of which $1,000,000 are outstanding; $2,000,000 of 7 per cent. three-year convertible debenture gold bonds, dated June 1, 1911, due June 1, 1914, interest payable June 1 and Dec. 1, all of which are outstanding. All of the bonds are convertible at par ($5) at any time up to their maturity, except the three-year debentures, which are convertible up to March 1, 1914.

There are $14,000,000 of $5 shares authorized, of which $6,000,000 are outstanding. Of the $8,000,000 shares authorized, but not outstanding, $7,000,000 are reserved in the treasury against the conversion of the outstanding bonds into stock at par ($5) and $1,000,000 are reserved against conversion of the remaining $1,000,000 7 per cent. convertible second collateral trust mortgage bonds, which have been authorized but not issued.

Cost Estimates

The estimate of cost is based on what has already been done at the Braden Copper Company's mines in a small way during the experimental stage, and on costs obtained at other properties of a similar character—the difference in conditions being, of course, considered. It takes in all disbursements necessary for operations and includes in addition to all possible expenses in Chile, all New York expenses. Instead of putting in an item of "General Expense," such expenditures are included under the several headings:

In the estimate the following factors are taken as a basis from which to figure: Average assay, 2.70 per cent. copper; extraction, 65 per cent., smelter 95 per cent.; yield of copper per ton ore, 33.5 lb.; average ratio of concentration, 9 to 1; average price per pound copper, 12½ cents.

The estimated costs per ton of ore are: Mining, $0.700; transport to mill, $0.100; milling, $0.500; smelting at $5 per ton concentrates (9 into 1), $0.550; converting at $8 per ton blister, $0.134; refining at $15 per ton blister, $0.251; freight at $12 per ton blister, $0.201; commission, etc., $0.043; total, $2.479. Cost per pound copper 7.4c.; profit per pound copper, 5.1c.; profit per ton ore, $1.708.

It is thought that leaching and electrolytic precipitation may reduce the cost per pound of copper by one-half to three-quarters of a cent, but this will require additions to the plant, which will not, however, be recommended before a thorough working test on a large scale is made on the ground, with a plant for that purpose now in course of erection.

Estimated Dividends, 13 Per Cent.

Allowing a production of 3000 tons per day, and 360 working days per year, the total tonnage treated would amount to 1,080,000 tons. A yield of 33.5 lb. of copper per ton ore at a cost of 7.40c. per lb., and copper at a price of 12.50c., would give an annual profit of $1,844,640. For each cent increase in the price of copper there would result an increase in the profit of about 19.6 per cent.

Until the bonds are converted into shares, the profit to be divided among the shareholders is estimated as follows: Annual profit as shown above, $1,844,640; interest on $4,000,000 bonds at 6 per cent., $240,000; interest on $3,000,000 bonds at 7 per cent., $210,000; leaving balance to be paid on shares, $1,394,640.

With 1,200,000 shares issued the profits per share will amount to $1.16, or 23.2 per cent. interest on the par value. With all bonds paid off and allowing for an issued capital of 2,800,000 shares, the annual profit per share would be at the rate of $0.658, or on the par value of the stock, 13.1 per cent. These figures allow for depreciation, which would be taken up in the costs, but not for amortization.

Expansion in Dinas Bricks

The expansion of Dinas or silica bricks is said[1] to be due to the conversion of the quartz into tridymite. The microscopic examination of a piece of Dinas brick, which has been exposed for a long time to the heat of a furnace, shows numerous crystals of tridymite in the ground mass, consisting, according to the amount of iron present, of a brown, red, or yellow glass surrounding the larger quartz grains.

Apparently the quartz does not pass directly into tridymite, but is first converted into a vitreous, amorphous or molten condition of lower density than tridymite. In sections of Dinas brick, which have been completely melted down, owing either to prolonged heating or to large amount of fluxing materials, traces of tridymite are wanting, and in their place strongly reflecting isometric crystals are found; these are probably crystobalite, which is stable at a higher temperature than tridymite. As a rule, the quartz grains of Dinas bricks are penetrated by fine cracks from which the vitrification starts, and the larger the number of cracks, the larger the number of small grains into which the crystals split up, and the more rapid the increase in volume on heating.

The percentage composition of material suitable for making Dinas bricks should be about 97½ per cent. silica, 1½ per cent. alumina, 1½ per cent. ferric oxide and small amounts of alkalis and magnesia. The lime added as a binding material should not exceed 2 per cent. of the mixture. Microscopic examination of burnt Dinas brick shows that there is practically no diffusion among the raw materials unless the brick has been actually melted. In an ordinary Dinas brick, from one-third to one-half the whole amount of quartz present has been converted into tridymite and a change of the remainder takes place more or less slowly in the furnace, but probably other factors such as porosity, the formation of fusible solutions, the change of the glass into tridymite, etc., tend to counteract the increase in volume.

[1] P. J. Holmquist, *Tonind-Zeit.*, 1911, 35, 1323-1327.

The Shamva Mines

Special Correspondence

The capital of the Shamva Mines, Ltd., which company owns a mine in the Abercorn district of southern Rhodesia, consists of 600,000 shares of £1 each, now valued at about £4. In mine development £40,000 has been spent and £320,000 working capital is still available.

The deposit consists of an impregnated zone in quartzites and grits on Shamva hill, 800 ft. high. The consulting engineer of the company estimates working costs at 8s. 6d. per ton; 2s. for mining, 4s. for treatment, 1s. for development and 1s. 6d. for general charges. A railway is now being built from Salisbury to the mine, a distance of about 70 miles. About 10,000 ft. of development work, adits, winzes, drifts and crosscuts, has been done at a cost of £2 1s. per ft., and to date 1,246,000 tons of ore has been developed above the first level at a cost of 5d. per ton. The value of the reserves is given at 5.14 dwt. with high values unreduced, and 4.13 dwt. with values reduced. Trial crushings have shown the true value to be probably 20 per cent. higher than the reduced values.

The orebody on the surface is apparently 1600 ft. in length with an average width of about 110 ft. The prospect level has disclosed ore, to date, 71 ft. wide and 680 ft. long, of an average tenor of 3.55 dwt. gold. The first level discloses ore for 920 ft., average width 110 ft., length 920 ft. The No. 2 level has been partially explored and one crosscut has disclosed 175 ft. of 10-dwt. ore unreduced, or 6 dwt. reduced.

There is a large tonnage of ore not included in the estimates that assays 2.5 dwt. A small mill and cyanide plant was erected to make milling tests on the ore broken in development and to ascertain the best method of treatment. These showed that an extraction of 90 per cent. might be obtained and that the ore could be economically reduced and treated. The upper level will be worked opencast. A plant to treat 40,000 tons per month will probably be erected as soon as the railway reaches the mine.

The Manufacture of Lithopone

Details of the manufacture of a white pigment in which may be utilized some of the byproducts of zinc metallurgical works.

NOTE—Abstract of an article in the *Oil, Paint and Drug Reporter*, Nov. 20, 1911; published by permission. Copyright, 1911, by the *Oil, Paint and Drug Reporter*.

Lithopone is, in its pure form, a product of the double decomposition of barium sulphide and zinc sulphate, consisting usually of 30.5 per cent. of zinc sulphide, 1.5 per cent. of zinc oxide and 68 per cent. of barium sulphate. It is often adulterated with china clay, gypsum or whiting (barium carbonate). Such is the Durabo White, which contains 24.5 per cent. zinc sulphide, 51 per cent. barium sulphate, 18 per cent. white clay, 5.5 per cent. infusorial earth.

The various grades produced by variations in the materials and in the process of manufacture differ widely in covering power, in oil requirements and coloring matter required to tint them, and must be adapted to their buyers: for instance, a lithopone for the linoleum trade or for the roller-shade manufacturers will vary widely from one intended as an interior wall paint.

REQUIREMENTS OF MANUFACTURE

The materials used in a successful lithopone plant comprise barytes (crude), coal, spelter, oil of vitriol, common salt, sal ammoniac, sodium phosphate, chlorate of potash, calcium chloride and caustic soda. Taking the average figures for several years, the percentages by weight of the consumption of these materials are as follows: Crude barytes, 37.30 per cent.; bituminous coal, 26.59; spelter or scrap zinc, 9.63; oil of vitriol, 22.05; rock salt, 3.39; sal ammoniac, 0.44; sodium phosphate, 0.14; chlorate of potash, 0.31; calcium chloride, 0.13; caustic soda, 0.2 per cent. The average yield of lithopone from this material was 41 per cent. of a normal grade, averaging 29.85 per cent. zinc sulphide, 1.63 per cent. zinc oxide and 68.52 per cent. barium sulphate.

The cost of manufacture depends upon the situation of the plant, a plentiful supply of clear water, as enormous quantities are required for the washing of the product; facilities for discharging the materials from railroad cars or boats, economical methods of handling the same, uptodate crushers, mills and furnaces. Neither must the placing of levigating tanks, filter presses and drying ovens or kilns be lost sight of and it will be noted that it requires quite a plant full of apparatus to manufacture a paying quantity of lithopone. To run it most economically means going day and night, with double shifts of men and only shutting down when it becomes necessary to clean out and repair furnaces, etc., because every shutdown means extra expense and a liability to produce inferior products until the plant is again in normal working order. Without going into minute details we may say that for a plant with a capacity of 10 tons every 24 hours, a building at a cost of about $25,000, fitted out with apparatus costing as much more, is required. The apparatus includes engine, two reverberatory furnaces, crusher for breaking the crude barytes, at least four large burrstone mills, disintegrator, elevator, etc., steam-heated drying rooms, a series of muffle furnaces, lined tanks for the zinc-sulphate and barium-sulphide solutions, 30 vats of about 1500 gal. capacity for washing the product, filter presses, trays for handling the precipitate, aside from numerous other tools and appliances. Where perfectly clear water cannot be had, large tankage for filtering the water for levigating the product is absolutely needed.

MANUFACTURE OF THE BARIUM SULPHIDE

The process of manufacture itself begins with the preparation of barium sulphide, usually termed black ash, which consists of breaking up the crude barytes in a crusher and running it through a burrstone mill to a certain size, about like a small pea, steaming it to avoid the dust, which is liable to clog the furnace, adding to every 100 lb. of this broken rock about 20 lb. of bituminous coal of small pea size, and about 10 lb. of common salt to assist fusion. This mixture is placed in a reverberatory furnace, where it is heated to dull redness without admission of air. When the reaction has taken place the mass is placed in vats, digested and filtered. When the crude rock contains, as is often the case, much clay, iron, etc., the pure barium sulphide must be leached out and the foreign residue removed. While this black ash and its solution is being prepared, spelter, zinc dross or scrap zinc or any available zinc salt is being dissolved in separate vats or tanks in sulphuric acid, forming a solution of zinc sulphate. The barium-sulphide solution and the zinc-sulphate solution should be of a concentration of 60 per cent. and at a temperature of 140 to 150 deg. F., when they are poured together, and the zinc solution should be poured at double the rate of the barium solution, in which case a precipitate is obtained that can be filtered and dried.

PURIFICATION OF THE ZINC SOLUTION

It is evident that when zinc dross is used and in any case unless refined spelter is employed, the zinc solution must be treated with a compound that will eliminate all traces of iron and other foreign materials. For this purpose chlorate of potash is added. The precipitate, after being filtered and dried, is placed in muffle furnaces and heated at as high a temperature as 900 deg., when it is suddenly plunged into cold water. In calcining in the muffle furnace, sal ammoniac to about 1 per cent. of the dry weight of the pigment is added to assist fusion. When the material is thus prepared it is carried to the burrstone mills by means of centrifugal pumps and pipes, or by other mechanical appliance and there ground in the pulp state to the standard degree of fineness, and then conveyed to the washing tanks, where it is washed over as often as it is necessary to eliminate all traces of impurities, free sulphur, iron, etc. This often requires as many as 12 to 15 washings and sodium phosphate and caustic soda are added in small portions to aid in the process. Calcium chloride is also added as a bleaching agent when the whiteness is defective. A minute quantity of ultramarine blue is also one of the ingredients to assist in eliminating too creamy a cast. When the test shows the pigment to be throughly washed, it is filter pressed, the cakes so formed are placed on wooden trays, the trays stacked up on suitable trucks and these put into drying rooms usually built of metal and heated by exhaust steam, which is aided by jets of live steam. When the cakes of lithopone have dried, they are fed into the hopper of a disintegrator, which pulverizes the lumps into a powder of uniform fineness, and when this powder has been put up in barrels or casks of suitable size, the product is ready for the market.

LOW CARRYING CHARGES IN FACTORY

The one great feature about the manufacture of lithopone, as compared with that of white lead, is in its quick manufacture, for a working batch of lithopone can be turned out in three of four days, whereas even quick-process white lead will require at least one month from the time the pig lead is unloaded, with one single exception, that of the so called mild process of white lead. It stands to reason that the capital tied up in a lithopone plant is much smaller than in the case of white-lead manufacture. Another advantage of the process as against that of white-lead making is that the

health of the workmen is not as much in danger, though the work is by no means pleasant, on account of the vapors and the heat. The cost of manufacture, exclusive of the capital invested, but including repairs to apparatus, superintendence and labor, should not exceed $10 per ton (2000 lb.), while the cost of material, packages, etc., necessarily varies with the condition of the market.

Tin Mining in Malaysia

The chief mineral mined in the Federated Malay States is tin ore, the working of which is of comparatively recent date. Years ago, says Vice Consul General David M. Figart, of Singapore, the Siamese mined it to some extent, but it was not until the advent of the Chinese that the states came into prominence as a tin-producing country. Tin is obtained from cassiterite by reduction in reverberatory or in Chinese blast furnaces. At least nine-tenths of the ore is obtained from alluvial deposits.

Lode mining on the east coast of the peninsula has been carried on almost exclusively by one company, with varying results. On the west coast, tin ore is found in the limestone, granitic and schistose formations. In the limestone rocks the ore occurs in "pipes," but such deposits are irregular and unreliable. In the granitic and schistose rocks small irregular veins are found which contain arsenical and sulphurous ores in addition to tin.

The alluvial deposits are worked by opencast mining, by underground methods and by ground sluicing, hydraulicking, or by dredging. The most suitable lands for opencast mining are broad flats in which the beds of tin-bearing ground are regular. Underground methods are resorted to when the deposits occur at depths which make opencast mining impracticable. This method is profitable only with the richer deposits. Dredging and hydraulic mining make it possible to work ground that otherwise would be untouched. By these methods, in some instances, ground carrying one-fourth to one-half pound of tin per ton may be profitably exploited.

There are 500 licensed purchasers of tin ore in the Federated Malay States. Over two-thirds of the ore is shipped to the Straits Settlements to be smelted, although 25 years ago the miners smelted their own ore. Chinese smelters in the states use primitive blast furnaces, with charcoal as fuel. Slag is treated nine times over until it becomes too expensive to work further. Chinese competition with the Straits Settlements smelters occur only when tin commands a high price.

Labor in the tin mines is almost entirely Chinese, only 5 to 7 per cent. being Indians, Javanese and Malays. There are two methods of employing laborers: They may be hired at the owner's risk, in which case the latter takes all profits, or the land may be let to the laborers for a fixed tribute. There were 184,699 laborers employed in the four states in 1909 and 170,361 in 1910.

The exports of block tin and tin ore from the Federated Malay States are given in the accompanying table.

State	Block Tin, Long Tons		Tin Ore, 70 per cent. of Gross Weight, Long Tons	
	1909	1910	1909	1910
Perak	6,868	6,549	20,612	18,540
Selangor	2,918	2,583	12,916	11,714
Negri Sembilan	270	7	2,592	2,058
Pahang	694	770	1,874	1,651
Total	10,750	9,900	37,994	33,963

Duty is levied on all tin and tin ore exported from the Federated Malay States and is calculated on a sliding scale which varies with the price on the London market.

Tomboy Gold Mines Company, Ltd.

The annual meeting of the Tomboy Gold Mines Company, Ltd., was recently held in London. The report shows that the operations of the mine in Colorado for the year ended June 30, 1911, resulted in a profit of £63,860. After making provision for depreciation of plant and machinery, income tax, commission to John Herron and meeting the two dividends of 2s. each paid during the year, there remained a credit balance of £51,431 to be carried forward.

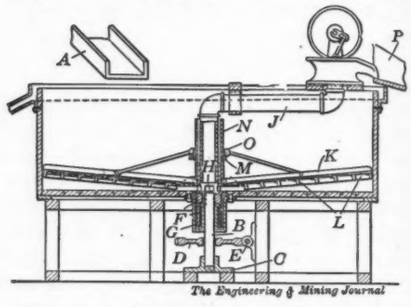
Development work to the extent of 1286 ft. was done during the year, almost all of which disclosed ore of a milling grade. The results of sinking below the 2100-ft. level are said to have shown that, for at least 100 ft., the orebody found on the level maintains its average width and grade. The ore reserves are estimated at 427,000 tons, 176,000 tons of which are found above the 1650-ft. level.

During the year, 116,222 tons of ore were milled. The costs for the year's operations are as follows: Mining, $1.42; development, $0.83; milling, $0.63; concentrating, $0.82; water supply, $0.17; assay office, $0.03; general expenses, $0.32; taxes, $0.16; total $4.38 per ton. Manager D. A. Herron reports that extensive tests indicated the desirability of greater concentrator capacity; regrinding of the coarser portion of the battery pulp and subsequent grading of all concentrator products. Alterations are being made in the concentrating department with a view to securing improved recoveries suggested by the above tests.

In July, 1911, the company acquired a portion of the property of the Revenue Tunnel Mining Company for $400,000. The ore from this new acquisition will be trammed from the mouth of tunnel intersecting the orebody to the 60-stamp mill, a distance of about 3300 feet.

The Lamb Slime Thickener

A slime thickening or decanting apparatus has been patented (U. S. pat. 1,007,954) by Mark R. Lamb and assigned by him to the Allis-Chalmers Company. The apparatus embodies a tank with a flat bottom and a discharge launder around its upper portion. The driving shaft *B* is mounted in a thrust bearing *C* concentrically with the tank and carries a wormwheel *D* meshing with the worm *E*. The arm-supporting frame *F* is keyed to the upper end of the shaft and has a downward projecting cylindrical portion which extends into an annular recess formed in the packing cup *G*. The recess formed in the cup is filled with mercury or similar packing. Passages *H* are formed through the wall of the frame, below the end of the pipe *J* and on a level with the bottom of the tank. The scraper or stirrer arms *K*,



VERTICAL SECTION OF LAMB SLIME THICKENER

each carrying a series of plates *L*, are pivoted to the frame. The collar *M*, which is fastened to the tube *N* by means of an ordinary setscrew, limits the downward travel of the collar *O*. The upper end of pipe *J* is connected to the inlet of a diaphragm pump.

During the operation of the device, the slime to be thickened is admitted to the tank through the inlet chute *A*, heavy particles passing directly to the bottom of the tank. The arms are caused to slowly revolve, thereby conveying the heavy particles from the periphery of the tank toward the passages *H* where they are drawn by the suction of the pump through pipe *J* and discharged at *P*. The clear liquid overflows and passes off through the annular launder. The arms and rabbles permit of adjustment to meet varying conditions.

According to the Geological Survey, the United States in 1910 excelled all other countries in the conversion of raw asbestos into manufactured products, but less than 1 per cent. of the asbestos used was mined in this country, by far the larger part being imported from Canada.

Hematite in Veins of Globe District

By John Sanders*

The action of alkaline or metallic carbonates upon sulphide minerals, such as pyrite, may account for the occurrence of hematite in association with pyrite and chalcopyrite in the Summit mine in Arizona.

*Formerly chemist, Summit Copper Company, Bellevue, Ariz.

As described by Ransome[1], the ore deposits of the Globe district of Arizona may be classed as (1) lodes, (2) masses in limestone, and (3) irregular mineralizations of shattered or permeable rocks. In this article, the Summit mine, situated in the Pinal schist or oldest formation of the district, is taken as typical of the first class and the Old Dominion, in limestone and other rocks overlying the schist, as representative of the second class; the third class is not at present taken into consideration.

Hematite Associated with Both Oxide and Sulphide Ores

The most prominent feature of the Old Dominion mine is the great depth of the zone of oxidation, extending to many hundred feet, sulphide ores not being encountered except in the deepest workings. On the other hand, in veins of the Summit class lying in the hard schist, while some oxidation may extend to a depth of 200 ft., sulphide ores are encountered almost from the surface down.

In both instances, however, hematite in large amounts is a constant accompaniment of the copper minerals, forming an aphanitic mixture with cuprite and other oxidized ores in the replacement veins of the Old Dominion type and existing mainly as specularite accompanying chalcopyrite in the lodes or fissure veins in the schist.

Speaking of the secondary origin of chalcocite, Ransome states that in the Summit mine this mineral occurs probably at less than 200 ft. in depth as a thin, black film coating fracture surfaces of chalcopyrite and often associated with hematite. He then gives reactions for the formation of chalcocite by the action of cupric sulphate on chalcopyrite and goes on to say that apparently a part of the iron formerly combined with copper and sulphur in chalcopyrite has been redeposited as hematite, by further oxidation of the ferrous sulphate. This was published in 1903, since which time further developments by the Summit Copper Company down to the 600 level have shown that specularite in large quantities continues to exist with chalcopyrite, showing no signs of alteration under the microscope. Some months ago, C. W. Pritchett, consulting engineer for the Summit Copper Company, doubting the truth of the generally accepted theory that most of the hematite in the Globe district is due to the residual iron from leaching or alteration of chalcopyrite, directed me to investigate the subject as illustrated by the ores of the Summit property.

[1]Professional Paper 12 (1903), U. S. Geol. Surv.

Formation of Hematite from Pyrite

In this connection, the work of Doctor Stokes referred to in Van Hise's "Treatise on Metamorphism" was recalled[2]. He succeeded in producing hematite and metallic sulphides by the action of sodium carbonate and a metallic carbonate on pyrite, the following being a typical reaction:

$$8\,FeS_2 + 14\,ZnCO_3 + Na_2CO_3 = 4\,Fe_2O_3 + 14\,ZnS + Na_2S_2O_3 + 15\,CO_2$$

Hematite alone was produced by the following reaction:

$$8\,FeS_2 + 15\,Na_2CO_3 = 4\,Fe_2O_3 + 14\,Na_2S + Na_2S_2O_3 + 15\,CO_2$$

In this case, the reaction is reversible but Stokes remarks that it will proceed to an end if the sulphide and thiosulphate be carried away as by a circulating solution or if there be present a metallic salt capable of precipitating the alkaline sulphide as fast as it is formed, as in the reaction above given.

No reference is made to the formation of copper sulphides but I have worked out the following reaction and offer it tentatively as a possible explanation of the occurrence of the two minerals in the Summit ores:

$$\underset{\text{(Azurite)}}{5\,FeS_2 + 2\,[CuCO_3 + Cu(OH)_2]} + 3\,Na_2CO_3 = \underset{\text{(Chalcopyrite)}}{Fe_2O_3 + 3\,CuFeS_2} + 2\,Na_2S + 5\,CO_2 + H_2O + Na_2S_2O_3$$

As stated in the original report, "against this theory is the fact that no residual pyrite had been found in any of the workings," the ore having always been remarkable for its extreme simplicity, consisting almost entirely of chalcopyrite and hematite with a little schist gangue. Later, C. Q. Schlereth, the assistant manager at the mine, discovered pyrite in hand specimens from the 400 down to the 600 level, the first specimen found finely illustrating the order of deposition of the minerals as in Fig. 1, which shows a broken and faulted pyrite crystal, the fault fissure being filled with specularite continuous with a larger body of the same mineral showing, under the microscope, numerous inclusions of clean, unaltered chalcopyrite. This latter feature is better shown in Fig. 2, which is another field in the same section. Other sections also bear out the inference that the pyrite is the oldest mineral and that the chalcopyrite and hematite are probably contemporaneous.

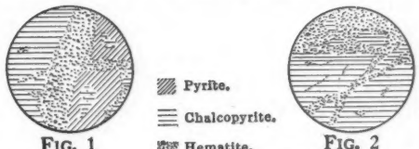


FIG. 1 FIG. 2

The Engineering & Mining Journal

PHOTOMICROGRAPH OF HEMATITE REPLACING PYRITE

Original Mineralization Cupriferous Pyrite

If the equation above given is admissible, and as it is one of deoxidation and decarbonation, the most plausible theory as to the mode of occurrence of the minerals is that the fissure veins in the Pinal schist were originally filled with barren or leanly cupriferous pyrite which was acted upon afterward by laterally moving and ascending carbonated waters, the minerals in solution being decarbonated and the pyrite being converted into specularite while its sulphur was partly taken up by the copper to form chalcopyrite and partly carried off as alkaline sulphide.

Owing to variations in local conditions as to openness of fissures and the like, the pyrite would be completely destroyed in parts of the vein and only partially affected in others. Afterward, by orogenic (mountain-forming) movements or denudation, the chalcopyrite or mixed chalcopyrite and pyrite being brought into the zone of oxidation, the usual alteration products caused by the action of the descending surface waters would begin to appear. In the veins of the Summit type where the oxidized zone is practically *nil*, there is only a superficial blackening of fracture surfaces of the chalcopyrite; while in the rocks overlying the schist, occur the enormously deep oxidized deposits. In these latter, the chalcopyrite has been entirely altered to cuprite and other oxidized ores, its iron furnishing at the same time more hematite to form the earthy admixture of copper and iron ore hereinbefore described. In other veins, the hematite may be entirely barren as derived from pyrite by the action

[2]Monograph XLVI (1904), U. S. Geol. Surv.

of sodium carbonate alone, according to Stokes' reaction.

As will be seen, two periods of activity are presumed in explaining the origin of the Summit ore. In the first, sulphureted vapors (or waters) deposited the original pyrite; in the second, solutions surcharged with carbon dioxide furnished the copper-bearing minerals which reacted upon the former. The original copper carbonate was probably supplied from minute quantities of copper disseminated throughout the schist.

Fallacies of Organic Origin of Petroleum*

By Eugene Coste

I intend to point out some of the geological and physical fallacies and impossibilities to which the theory of the organic origin of petroleum has led its supporters. If one analyzes impartially the evidence in regard to the connection of bituminous shales and of fossiliferous strata and other sedimentaries with petroleums, the following are the observed facts:

(1) Bituminous shales, really containing bitumen or petroleum as such, never constitute widely and uniformly spread sheets, nor thick horizons; they are to be found only as isolated patches of comparatively small extent along faults, fissures or joints or in brecciated zones of sandy shales, and the secondary nature of their bitumen, as an impregnation or infiltration product subsequent to the deposition of the shales, is as a rule plainly evident.

(2) So called bituminous shales, forming entire sheets or horizons in the sedimentary formations, are really not bituminous shales, or shales containing bitumen or oil as such, but they are black carbonaceous shales containing the carbon as coal. During the formation of the carbonaceous matter of these shales, from the slow decomposition and graded carbonizing of organic matter at low temperatures, no more petroleum was produced than during the similar formation of coal beds, which as is well known are not in any way connected with and do not give rise to petroleum deposits. From the carbonaceous matter of the shales, as well as from the coal of the coal beds, petroleum-like substances can be distilled artificially at high temperatures, but in nature the distillation did not take place for want of the necessary heat, and all these coals remain undistilled and are found today in that state. The very fact that by applying heat to these "coals" we can produce petroleum-like substances artificially, is the best proof that nature did not carry on this experimentally possible process of production of petroleum-like substances and did not transform vegetation into petroleum. Nature, on account of the low temperatures prevailing in her sedimentary processes, only carried on the carbonization of vegetable organic matter; and the distillation of it, which alone is known to give off petroleum-like products, still remains to be performed by artificial means.

(3) Even very fossiliferous strata, supposed to be so full of organic life, contained when finally deposited only the remains of the hard calcareous or silicious parts of the organisms, from which no petroleum could possibly be at any time produced. No really organic matter was finally entombed in the strata with these hard parts of the organisms, as their soft tissues had decayed completely and disappeared entirely before the final and complete deposition of each stratum could take place.

(4) Petroleums, as a general rule, are not associated with fossils, which are, everywhere and in strata of every age (except in very rare cases of subsequent infiltration and replacement), absolutely devoid of petroleum of any kind.

(5) The association of petroleums with sedimentary strata is one of secondary and subsequent replacement and impregnation of porous patches, pools, fields or veins, and is no more a proof of the organic origin of petroleums than is the similar association of volcanic rocks with sedimentary strata, everywhere to be seen. Both these associations of volcanic rocks and of petroleums with sedimentary strata are of the same order, viz., one of the subsequent incoming or intrusion in the fissures, voids or spaces of the sedimentary crust.

(6) Not only shales, but almost all other strata, constitute, in the unaltered sedimentary formations of the oilfields, saturated impervious beds; and this imperviousness entirely precludes the supposition that oil, gas and water could travel through the fine pores of these sediments, which, from the time of their deposition were already occupied by water. Had it been otherwise at any time it is evident that any oil or gas in these sediments would have escaped to the surface. In order to explain the detention in the strata of certain districts of so many gas and oil pools under very strong pressures, it is necessary to assume not only impervious covers to these pools, but also impervious substrata and impervious sides; and, since the sediments surrounding these oil and gas pools are impervious to these products, how can they be held to be the source?

(7) The mode of occurrence of the petroleum deposits in the sedimentary strata of all ages, but in certain districts only, and the constant recurrence of hydrocarbons in volcanic and igneous rocks, in volcanic emanations, in metallic and other veins, in meteorites, in comets and other stellar bodies, clearly demonstrate that petroleums are not organic; if they were, their distribution could not possibly resemble the actual occurrences which are met with. The petroleum deposits in the sedimentary strata are not everywhere associated with rocks of a particular age in each geological province, as are the coals, but they are found in strata of all ages and only along some of the tectonic structural disturbances to which these strata were subjected, where they aline themselves in "petroliferous provinces" as do the metals in "metallogenetic provinces." Where there are no structural disturbances the same strata are entirely barren of petroleums. This is due, in the case of the petroleums as in the case of the metals, to the same causes, i.e., dynamic disturbances accompanied by magmatic emanations from the interior. These hydrocarbon emanations sometimes follow closely the volcanic lava, as in the Mexican oilfields, but they need not be and often are not accompanied to the surface by volcanic rocks. They must, nothwithstanding, everywhere be held to be of a solfataric volcanic nature, as shown by their peculiar position along the tectonic structural disturbances, and because they could not originate in the mass of the impervious sediments and could only travel through these by means of faults and fissures from deep sources. Besides, with their associated salt and sulphur they are identical with the solfaric volcanic vapor emanating from all the volcanic districts of the earth, and are absolutely unlike anything else known to be today in the active process of formation in nature. Like volcanic vapors, these hydrocarbons are always found under high pressures, often giving rise to violent explosions and sudden outbursts, in enormous quantities, after earthquakes, shocks and along disturbed dynamic axes, and, like volcanic vapors, they are also found at time to be still hot and associated with hot waters.

*Excerpts from a paper entitled "Fallacies in the Theory of the Organic Origin of Petroleums," Bull. 85, I. M., M.

Oil in Argentine

The president of the Argentine Republic has recommended the appropriation of $850,000 for the exploitation of the petroleum deposits in Comodoro Rivadavia, according to U. S. Consul General R. M. Bartleman at Buenos Aires. This is the result of an investigation by the petroleum commission appointed by the government. A contract has been concluded with the German Transmarine Electricity Company, of Berlin, to handle the output of the district.

NEW PUBLICATIONS

THE MINERAL INDUSTRY OF RHODESIA. By J. P. Johnson. 5¾x8¾, pp. 90. Longmans, Green & Co., London.

PORCUPINE MINING DISTRICT, Vol. I, 1911. 7¼x9½, pp. 86, paper. Canadian Mining Journal, Toronto, Ont.

POOR'S MANUAL OF RAILROADS OF THE UNITED STATES, 1911. 6x9, pp. 2716. Poor's Railroad Manual Company, New York.

A TREATISE ON HYDRAULICS. By Hector J. Hughes and Arthur T. Safford. 6x9, pp. 505, illus. $3.75. Macmillan Company, New York.

LABOR LEGISLATION ENACTED BY THE FORTY-SEVENTH GENERAL ASSEMBLY OF ILLINOIS, 1911. Pp. 141. Bureau of Labor Statistics, Springfield.

STRAIGHT LINE ENGINEERING DIAGRAMS. By Manifold and Poole, 5x7¼, pp. 96; $3. Technical Publishing Company, San Francisco, Cal.

ELECTRO-ANALYSIS. Fifth Edition, Revised. By Edgar F. Smith. 5½x7½, pp. 332, illus., leather. $2.50. P. Blakiston's Son & Co., Philadelphia.

HANDBOOK OF STEAM-SHOVEL WORK. 4½x7, pp. 374, illustrated; $1.50. Report by the Construction Service Company to Bucyrus Company, Milwaukee, Wis.

RAPPORT DES OPÉRATIONS MINIÈRES DANS LA PROVINCE DE QUEBEC, DURANT L'ANNE 1910. Pp. 109, illus. Ministère de la Colonisation, Bureau des Mines, Quebec.

THE TERTIARY GRAVELS OF THE SIERRA NEVADA OF CALIFORNIA. By Waldemar Lindgren. Pp. 226, illus. Professional Paper 73, U. S. Geological Survey, Washington.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1910, WITH SUBJECT INDEX. By John M. Nickels. Pp. 179. Bull. 495, U. S. Geological Survey, Washington.

GEOLOGY AND ORE DEPOSITS OF THE BRECKENRIDGE DISTRICT, COLORADO. By Frederick Leslie Ransome. Pp. 187, illus. Professional Paper 75, U. S. Geological Survey, Washington.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF MINES TO THE GOVERNOR OF THE STATE OF OHIO FOR THE YEAR ENDING DEC. 31, 1910. Pp. 497. George Harrison, Chief Inspector of Mines, Columbus, Ohio.

THE MINING INDUSTRY OF MEXICO. Compiled and edited by F. Gonzales, A. Grothe and L. Salazar S. No. 1, State of Hidalgo, part I. 8x11½, pp. 73, paper. Vda. de Bouret, Avenida Cinco de Mayo, num. 45, Mexico, D. F.

HANDBOOK OF PIOCHE. 4¾x8¾, pp. 60, illus., paper. Compiled and published by W. O. Sutherland for R. K. Cobb & Co., Salt Lake City, Utah.

Contents: Pioche, by James W. Abbot; the probabilities of Pioche, by Frederick J. Pack; the geology and mineral resources of the Pioche district, by Robert N. Bell.

TECHNOLOGY AND INDUSTRIAL EFFICIENCY. PROCEEDINGS OF THE CONGRESS OF TECHNOLOGY, 1911. 6½x9½, pp. 486, illus. $3. McGraw-Hill Book Company, New York.

A series of papers presented at the Congress of Technology, opened in Boston, Mass., April 10, 1911, in celebration of the fiftieth anniversary of the granting of a charter to the Massachusetts Institute of Technology.

MINERALOGICAL NOTES. By Waldemar T. Schaller. Pp. 109. Bull. 490, U. S. Geological Survey, Washington.

In this bulletin is given a report of the mineralogical work of a research character conducted in the chemical laboratory of the Geological Survey from 1905 to 1909. Among the minerals described are hulsite, paigeite, jamesonite, warrenite, ludwigite, bismite, axinite, albite, phenacite, neptunite, siderite, barite, purpurite, heterosite, powellite, evansite, and new forms of calcite.

METALLURGY OF TIN. By Henry Louis. 6½x9½, pp. 138, illus.; $2. McGraw-Hill Book Company, New York.

This is, as stated in the preface, mainly a reprint of the author's monograph on tin, published in the "Mineral Industry" for 1896, with as much new information incorporated as is attainable. Knowledge in the metallurgy of tin is a jealously guarded matter, which probably accounts in part for the backwardness of the art. However, what is public information is clearly and briefly stated.

TABLES FOR THE DETERMINATION OF MINERALS. By Edward H. Kraus and Walter F. Hunt. 6¼x9¼, pp. 254, $2. McGraw-Hill Book Co., New York.

The classification of the 250 minerals described in this book is based upon physical properties. The main distinction is according to luster; the subdivisions, according to color, and the further differentiation according to streak and hardness. These properties are made the heads of each set of tables, under which the physical properties of each mineral are described.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES. 7½x10½, pp. 1419. $10. S. E. Hendricks Company, New York.

The twentieth annual revised edition of this directory of engineering and architectural products contains 124 pages of new matter. A new system of indexing has been adopted in this edition; each classification is numbered and the index number refers directly to it instead of to the page on which it appears. The simplicity and completeness of its classification should recommend the volume as a directory of manufacturers and their products.

SOME CHEMICAL PROBLEMS OF TODAY. By Robert Kennedy Duncan. Pp. 254, illus.; $2. Harper & Brothers, New York.

Professor Duncan, who is the director of industrial research at the University of Pittsburgh and at the University of Kansas, is well known to the public through his earlier book, "The Chemistry of Commerce." He possesses in a phenomenal degree the art of reducing the profoundest discoveries of chemistry and physics to their elements and presenting them in language that is not merely easily intelligible to the layman, but also is engaging because of its fluency and literary excellence. Science is indeed a romance. Professor Duncan writes about it in a romantic way and succeeds in conferring upon such themes as "The Question of the Atom" the same popular interest that is possessed by a good detective story. His new book does not fall short of its predecessor.

SUMMARY REPORT OF THE MINES BRANCH, CANADIAN DEPARTMENT OF MINES FOR THE CALENDAR YEAR, 1910. Pp. 243, paper, illustrated. C. H. Parmelee, King's Printer, Ottawa.

The contents of this publication indicate the varied and comprehensive character of the work pursued by the Mines Branch and the important economic results obtained in several directions. Among the more important special undertakings initiated or continued during the year, in addition to the work of mineralogical investigation, were the operation of a government peat-manufacturing plant at Alfred, Ont., which has successfully demonstrated that this industry can be profitably carried on on a commercial basis; the establishment of a government ore-dressing and concentration laboratory at Ottawa to test modern methods of ore dressing as a means of utilizing low-grade iron ores; and an investigation of the numerous fatal accidents caused by explosives resulting in the framing of a bill regulating the manufacture, testing and storage of all explosives to be submitted to parliament. The field work accomplished included a study of the building and ornamental stones of Canada by Prof. W. A. Parks; an investigation of the mica deposits of Ontario and Quebec by Hugh S. de Schmid, who in the course of his researches visited over 200 properties; an examination of the copper-mining industry in Ontario by Dr. Alfred W. G. Wilson, and investigations of iron-ore deposits in the maritime provinces and Quebec by E. Lindeman and Howells Frechette.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. H. Leggett has returned from a Western trip.

Oscar Bergstrom has taken charge of the Rea mine, Porcupine, Ontario.

Donald G. Miller, of Cumpas, Sonora, Mexico, is spending the holidays in New York.

E. A. Blanton, Jr., of Philadelphia, has been in Houghton, Mich., on a visit to the copper country.

Dyke V. Keedy, of the firm of Dietz & Keedy, Boston, is in Texas on professional business.

Ralph Anderson has resigned the management of the Apex mine and has left Porcupine, Ontario.

Robert H. Richards, of Boston, is spending a week at Hancock, Mich., on professional business.

Augustus Locke is going to El Oro, Mexico, to conduct a geological survey of mines at that place.

Morton Webber has gone to London on business and will return to New York about the end of the year.

Thor Warner has removed his office and headquarters from Haileybury to South Porcupine, Ontario.

Carl J. Stahl spoke to the mining men of Ouray, on Dec. 9, on the "National Forests and the Prospector."

F. Lynwood Garrison has gone to Arizona and California, whence he does not expect to return until January.

Prof. George W. Schneider, of the Colorado School of Mines, visited Telluride and Ouray early in December.

H. V. Winchell lectured to the Geological Club, University of Minnesota, Dec. 7, on the "Secondary Enrichment of Ore Deposits."

Ott F. Heizer has resigned as superintendent of the Coalition mine at Seven Troughs, Nev., and is now at Virginia City, Nevada.

S. F. Shaw has removed from Los Angeles, Cal., to New York City, and will continue handling examination and consultation work.

Robert K. Painter, Frank Loring and E. M. Loring, of Benson Mines, N. Y., are in the Sturgeon Lake district, Ontario, where they have large mining interests.

A. E. Anderson, of the Du Pont Powder Co., on Dec. 8, delivered a practical talk on "Recent Developments in Explosives" to the mining men of Telluride.

Philip D. Wilson has left the Copper Queen smeltery at Douglas, Ariz., and will be engineer for the Transvaal Copper Mining Co., at Cumpas, Sonora, Mexico.

Fred. Hellman, who has lately returned from Europe, has gone to the West on professional business, expecting to return to New York about the end of December.

A. Blum has resigned his position as consulting engineer of the Compañia de Minerales y Metales, Mexico. His present address is 4a Calle de Humboldt, 48, City of Mexico.

Dr. George F. Kunz, New York, the well known gem expert, has received the decoration of the Order of the Rising Sun from the Emperor of Japan, in recognition of his work in mineralogy.

R. H. Hawley, recently metallurgical engineer for the Magna and Arthur plants of the Utah Copper Company, has been appointed assistant superintendent of the company's plant at Magna, Utah.

J. D. Archbold has been chosen president; J. A. Moffatt, A. C. Bedford and W. C. Teagle, vice-presidents, of the Standard Oil Co. of New Jersey, in place of John D. Rockefeller, William Rockefeller, C. M. Pratt and H. M. Flagler, resigned.

J. C. Maben, Jr., has been elected a vice-president of the Sloss-Sheffield Steel & Iron Co., and will have charge of the physical operation. J. W. McQueen continues vice-president in charge of sales and financial operations. J. C. Maben, Sr., president of the company, will remove from Birmingham, Ala., to New York.

L. M. Hardenburg has been appointed general superintendent of Pickands, Mather & Co.'s mines on the Gogebic range—the Windsor, Cary, Mikado, Sunday Lake and Brotherton properties. He will make his headquarters at Ironwood. Mr. Hardenburg has served the company a number of years. Until recently he has been stationed at the Cary mine.

OBITUARY

Elisha H. Flinn, president of the Northern Iron & Chemical Co., died Nov. 24, at Detroit, Mich., aged 67 years. He had resided in Detroit since 1865 and his business interests at the time of his death were extensive, including a large ownership in blast-furnace property. Prior to the sale of the company to an Eastern and English syndicate, he was president of the Lake Superior Iron & Chemical Co. He leaves two children.

Cornelius Reilly, retired miner, died at Berkeley, Calif., Nov. 17. Mr. Reilly came around the Horn to California in 1852. He was born in Ireland, and was 88 years old at death. He was connected with practical mining in the early days and was superintendent of the Allison Ranch mine at Grass Valley, and an owner with James Flood, John W. Mackay and William O'Brien. Later he was associated with Cecil Rhodes and Whitaker Wright in the direction of an engineering enterprise in England. He acquired a large fortune in mining enterprises and on the San Francisco Mining Exchange, a part of which was lost through the decline in securities in 1906, at the time of the San Francisco disaster.

James N. Stower, Plattsburg, N. Y., died Dec. 1, aged 67 years. He was born in Essex, N. Y., and received his education in the public schools. Early in his manhood he became interested in the development of the iron industry in northern New York, being one of the pioneers in the iron trade in that section. In 1864 he entered the iron business with his brother, William H. Stower, at Lewis, Essex County. In 1873 he purchased the forge property at Willsboro in the same county, and engaged in the manufacture of bloom iron for boiler plate and billet iron for crucible-steel melting stock. Subsequently he accepted the position of superintendent of the Crown Point Iron Co.'s forge department in Essex County. In 1885 Mr. Stower was elected manager of the Hudson River Ore & Iron Co., at Burden, Columbia County, which position, together with that of secretary and treasurer, he held up to the time of his purchase of the company's entire property about a year ago. In 1893 he accepted the position of general manager of the Chateaugay Ore & Iron Co., Chateaguay Railway Co. and Saranac & Lake Placid Railroad Co., taking up his residence in Plattsburg. He continued as general manager for the Chateaugay Ore & Iron Co. until 1904, when he resigned to devote his time to his private business.

SOCIETIES and TECHNICAL SCHOOLS

American Institute of Chemical Engineers—As previously announced, the fourth annual meeting will be held at Washington, Dec. 20 to 23. A number of excellent papers on several chemical engineering processes have been prepared. The manufacture and testing of shipping cylinders for compressed gases will be treated in a very comprehensive manner in two papers. A monograph on the use of centrifugal pumps will be presented at one session. A symposium on the very important subject of the United States patent system has been arranged. The United States patent commissioner and several of the leading patent attorneys of the United States will address the institute on this subject. The institute has been unusually fortunate in securing permission to visit the United States proving grounds at Indian Head, Md., where the manufacture of explosives, as well as the testing of heavy ordnance, may be witnessed. Opportunity will also be given of visiting the various buildings of the Bureau of Standards and the Patent Office.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Dec. 7—The Home Industry League has become a factor in the publicity of important data regarding the structural and industrial metal and mineral substances produced in California. This has been accomplished through papers read by members at the meetings of the league and by public exhibits. While the papers and exhibits are by no means confined to these products, but include about everything produced and manufactured in the state, they deal largely with such materials as are commonly overlooked in the records of mineral substances by the press and the description of California products. The attention of investors has been generally attracted to the petroleum and the gold resources while numerous commercial materials employed in structural work in the state, particularly sandstone, marble and magnesite bricks, as well as firebricks, have been obtained from other states. This lack of patronage of home products has been due largely to the railroads whose efforts have been directed rather to long-haul freight than to the development of the structural resources of California. The earthquake and fire of 1906 proved clearly the merit of California sandstone and created a large demand for California cement and concrete material.

There has been much talk of the failure of California brickmakers to take advantage of the considerable deposits of magnesite in the state, but the fault has not been so much a lack of appreciation of these deposits as the inability of the manufacturers to find a material that will serve as a satisfactory binder. Recent experiments have evolved a process of combining other materials with magnesite in the manufacture of floor tiling or paving that is proving wholly satisfactory, and for several years the Southern Pacific company has made magnesite bricks at its shops in Sacramento that are said to serve their purpose. The failure to employ the various materials in structural work has not been wholly due to the railroads nor to a lack of publicity, but in a great measure to the lack of exploitation and development by the owners of these deposits.

The State Mining Bureau has for several years directed attention to building materials, and for several months has been preparing an addition to the mineral exhibit in the form of an important and attractive display of practically all the structural metals and minerals produced in the state. The car recently sent out to be made a part of the governors' train that is making a tour of the East contains a comprehensive exhibit of these materials. Preparations are underway for a display of all these products at the Panama-Pacific fair in 1915 that will be complete in every detail and will demonstrate thoroughly that California is capable of producing about all the essential industrial and structural minerals, as well as gold, petroleum, copper, quicksilver and other important mineral substances.

Denver

Dec. 9—An important suit has been brought against the Government, represented by F. W. Howbert, internal revenue inspector of this district, by Strattons' Independence, in which the company seeks to recover $850 in taxes, paid under the law of 1909. On the principle that the more ore is extracted from a mine the less the mine is worth, and that by extracting ore it is changed from realty to personalty, thus depreciating the worth of the property, the attorney for the company holds that the taxes ought not to be assessed. The inspector, acting under orders from Washington, holds that the company should pay on the basis of the estimate of the tonnage in sight Jan. 1, 1909. As a test case, it is of great importance to all mining companies, more especially since if the company wins its case, the coal companies will probably take the matter up on the same lines.

Near the line between Utah and Colorado on the 40th parallel, through which territory runs the survey line of the Denver Northwestern & Pacific Ry., is a large area of gold-placer ground adjacent to Green River. During the last season the Green River Gold Dredging Co., composed of Denver and San Francisco men, made extensive tests of the ground with gratifying results, and it is stated that dredges will be installed there next summer.

The output of the Cripple Creek district for November is given at $1,356,966 with a tonnage of 77,204. Owing to the drainage of the mines now being effected by the recent increased flow from the deep-drainage tunnel, many properties are gradually increasing their forces. The flow from the portal is now 8500 gal. per min. The Clancy plant, at the Ajax, is in operation and will have its tonnage to report for December. The Portland mill reports 11,800 tons treated in December and the Argall mill, of Strattons', its usual 10,300 tons.

Butte

Dec. 6—A meeting of the stockholders of the Southern Cross mine will be held on Jan. 2, 1912, to confirm the recent sale of the property to the Anaconda company. The mine which is in the Georgetown district, a few miles from Anaconda, was formerly owned by Sen. Lee Mantle and the H. L. Frank estate, and has produced heavily in the past, but for over a year it has scarcely been touched, owing to the refractory nature of the ore as depth was attained in the mine; as a smelting ore, however, it makes an excellent flux, and with the new extension of the Butte, Anaconda & Pacific Ry. to the property it is expected to be a profitable investment. The shaft has not yet reached the 400-ft. mark, but according to experts who were at work for about a month in the interests of Eastern men over a year ago, there are about 300,000 tons of ore opened, averaging between $10 and $15 per ton, principally in gold.

The work of extending the Butte, Anaconda & Pacific Ry. to the Georgetown mining district has been started, and a force of surveyors, under Chief Engineer Lemmon, is making surveys for sidings on the northwest side of Silver Lake, where a station will be built; after this the survey of the line to the terminal point in the midst of the district will begin. Manager Gallwey states that practically all of the options for the right-of-way have been obtained from the various property holders on terms satisfactory to all parties concerned; indeed, the people, realizing the immense advantage that will accrue to that section from the extension, are lending the company every assistance possible, in its plans.

According to the United States Assay Office at Helena, Madison County produced, during November, gold worth $82,566, which was nearly half of all the gold produced in Montana counties. Most of this amount was taken from the dredges of the Conrey Placer Co., at Ruby. Chouteau County and Fergus County, respectively, were next in the order of production. The amounts from the various counties were: Madison, $82,566; Chouteau, $22,555; Fergus, $20,268; Deer Lodge, $4889; Missoula, $3456; Silver Bow, $3320; Jefferson, $2028; Lewis and Clark, $973; Ravalli, $447; Powell, $306; Granite, $255; Broadwater, $95; Park, $16.39.

Salt Lake City

Dec. 7—A mill is being built on one of the properties of the Grasselli Chemical Co., of Utah, below Park City, for the purpose of retreating tailings which contain some lead, but whose principal metallic content is zinc. The Macquisten flotation process will be used. Twenty-four Macquisten tubes will be installed. The process is being used at the Morning mine, at Mullan, Idaho.

Some attention is being given to what are reported to be potash deposits in Cottonwood Cañon, about 10 miles southwest of Marysvale, in Piute County. There is an extensive belt of eruptive rocks, chiefly rhyolites and andesites with accompanying tuffs, in this section, extending some distance west and north of Marysvale, along the Sevier Cañon. The occurrence is a vein carrying a large amount of pink spar, which is reported to be traceable for nearly a mile and to outcrop from 12 to 25 ft. wide. This has been opened to a depth of 50 ft. in places. Another deposit has been found in the neighborhood and an analysis of material from this occurrence is reported to have corresponded closely to alunite, a hydrous potassium aluminum sulphate. Chicago men have secured control, and a contract has been given for mining 100 tons for experimental purposes. The deposit is about seven miles from the Sevier River and it has been proposed to build an aërial tram to a point about three miles from Marysvale, and to extend a spur to this from the railroad, if the deposit should warrant it.

Work has again been started at the Daly property, which has been idle for a number of years. E. P. Jennings, consulting engineer, has examined the ground, and laid out development in the interest of Col. E. A. Wall, who recently secured control. The ore in this part of the camp occurs in fissure veins in the quartzite, which pass from the Ontario through the Daly to the Daly West and Daly-Judge, and are the source of mineralization for this section of the camp. There is a block of unprospected ground between the 1200 and 1700 levels. Work is being done on the 800 and 1700 levels, and 20 men are employed.

Deadwood

Dec. 8—The annual report of State Mine Inspector R. L. Daugherty, covering the year ended Oct. 31, 1911, discloses a most encouraging state of affairs, with a greater production than ever before recorded for a similiar period of time. The output of the mines for the year is given at $7,625,506. The largest producer was the Homestake, from which 1,511,302 tons of ore yielded $5,875,000. The Mogul treated 135,000 tons, recovering $481,700; Golden Reward, 66,899 tons, $392,701; Wasp No. 2, 148,700 tons, $295,907; Lundberg, Dorr & Wilson, 21,018 tons, $75,754; New Reliance, 8300 tons, $31,492. The New Reliance began operations in June, so that its figures cover about five months. Other producers which did not give detailed figures were mines at Keystone, Custer, the Castle Creek dredge and Trojan Mining Co., but they are included in the grand total. The gross tonnage for the Black Hills is estimated at 1,945,329, and men employed, 3974. The gross output of placer gold is estimated at $83,000.

The Homestake company is having plans prepared for a clubhouse for the benefit of its employees, which will be erected at Lead, at a cost estimated at $75,000, furnished and equipped. The building, which will be on Main St., on land adjoining the Episcopal church, will contain reading rooms, gymnasium, assembly hall, baths, kitchen, etc., and will be maintained by the company. A board of directors will be elected each year from among the employees, who will supervise the conduct of the affairs. Construction will start as early in the spring as practicable.

Negaunee, Mich.

Dec. 9—Mining men in the Crystal Falls district are interested in the announcement that Corrigan, McKinney & Co. are beginning the construction of eight new openhearth furnaces in Cleveland, where the company already has two modern blast furnaces.

Corrigan, McKinney & Co. are the dominant interests in the iron-ore field at Crystal Falls, where they have large resources of nonbessemer ore that can be utilized for openhearth steel. At present the mines at Crystal Falls are doing little but it is hoped that the new furnaces will make a market for the ores so that operations will be resumed. The company owns the Dunn, Tobin, Great Western, Crystal Falls and Armenia mines at Crystal Falls; the Tully mine and several undeveloped tracts of land at Iron River; the large Stevenson mine at Hibbing, Minn., and several other properties on the Mesaba range. W. J. Richards, of Crystal Falls, who recently was president of the Lake Superior Mining Institute, is general superintendent for Corrigan, McKinney & Company.

President W. J. Olcott, of the Oliver Iron Mining Co., which is the mining department of the U. S. Steel Corporation, has given out the following statement relative to the operation of the corporation's underground mines in the Lake Superior district: "So far as I am able to determine at the present time, we shall work through the winter at underground properties with about the same force as is now employed. As to mine-stripping operations, I am unable to state at present the extent of activity in that direction during the coming winter." In general throughout the iron region, the production of ore for stocking is much curtailed, but exploration, development and construction work are going ahead encouragingly. The Oliver company has recently let a contract to Cole & McDonald for diamond drilling on S.36-T.43 N.-R.33 W., near the Dunn mine in the Crystal Falls district.

Toronto

Dec. 8—Chairman J. L. Englehart, of the Temiskaming & Northern Ontario Ry. commission, has announced that early in the spring a branch line will be built into the Elk Lake district, about 30 miles in length, extending from the main line to the shore of Elk Lake. This will give transportation facilities to a number of silver mines in that area, which have been closed on account of heavy freight charges. A good farming country will also be opened.

The action of W. Marshall and the Greys Siding Co. against R. G. Leckie and the Drummond Mines, Ltd., involving $150,000, and the title to several hundred acres of mining lands in the Temagami Lake district, was dismissed on Dec. 1, by Judge Greenshields, of Montreal. The action was based on an agreement between Marshall and Leckie, under which Leckie undertook to secure certain mining lands from the Ontario government and to deliver the titles to Marshall, for which $250,000 were to be paid him in installments. Leckie bound himself to forfeit $150,000 in case he did not carry out the agreement. The interests of Leckie were assumed by the Drummond Mines, Ltd., and those of Marshall by the Grey's Siding Co. The agreement was not carried into effect and suit was brought for the forfeiture. The judge ruled that the defendants were not liable, because the plaintiffs had not tendered the installments in due time to be paid for the properties.

Porcupine

Dec. 8—It is stated on good authority that the Temiskaming & Northern Ontario Ry. will continue the Porcupine branch through to Sudbury, and that from Metagami, the present terminus of the Porcupine branch, a line will also be run through to Charlton. The Charlton branch would pass through the Larder Lake gold district, and both lines would serve to open up a stretch of country that offers large possibilities for the discovery of mineral.

Robert R. Black, of Haileybury, is suing M. L. Foly, T. Bastian, J. W. Blanchette and T. J. R. Laurendeau for alleged breach of contract, misrepresentation and conspiracy, and for a declaration that the plaintiff is entitled to one-sixth interest in 300,000 shares given Laurendeau by the Hughes Mines, Ltd., and to a one-sixth interest in all profits made by the defendants in connection with their dealings in these claims. The Porcupine-Hughes property was sold some time ago to Montreal men for a large amount.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

Pinochle Gold—This company is making extensive preparations for working the claims, near Valdez, next spring. Ore running as high as $400 per ton has been found. Ernest King is in charge.

Niggerhead—Sandstrom & Fisher, of Fairbanks, owners of this group, have closed work temporarily, having worked 160,000 sq.ft. of bedrock this season. They are preparing to block out more pay gravel and open it next summer.

Alaska-Juneau — Operations at this mine have ceased for the season, but a crew will be kept at work on the tunnel all winter.

Alaska-Treadwell—During October the mills crushed 78,316 tons of ore yielding $196,473 gross and net $105,509. Operating expenses were $75,593; construction, $17,369. Development work amounting to 1053 ft. was done and the ore crushed averaged $2.53 per ton.

Arizona

Gila County

Southwestern Miami—Churn-drill hole No. 1 has been discontinued at a depth of 1285 ft., being bottomed in ore. On account of the great depth and the fact that the ground was caving badly near the bottom of the hole, it had to be abandoned. It is by far the deepest hole ever drilled in the Miami district, and great credit is due for attaining this depth. Many holes have been abandoned on other properties at much less depth, and before the ore had been passed through. The drill will be moved to a point 400 ft. east of this hole and about 450 ft. from the nearest holes on Live Oak ground, some of which are known to have disclosed good ore. Hole No. 1 seems to have shown beyond doubt the continuation of the Live Oak orebody into Southwestern Miami ground, having disclosed a thickness of 175 ft. of chalcocite ore. Assay returns are not made public, as it is the policy of the management to withhold this information until more holes have been drilled.

Live Oak—Two churn drills remain in operation, one of the holes being now in ore. Drifting has been temporarily discontinued on the 800-ft. level in No. 2 shaft, while a station is being cut at the 900-ft. level, after which drifting will begin on both levels. Drifting on the orebody from No. 1 shaft, on the fourth level, is in progress and raises are being put up on some of the churn-drill holes, the assays checking closely with those made during the progress of drilling. It is reported that engineers' estimates differ as to the tonnage of ore developed.

Superior & Boston—The cutting of the station on the 12th level in the McGaw shaft is nearly completed, and the crosscut to the Great Eastern and Old Dominion veins will soon be continued. It is probable that diamond drilling will not be resumed, as the results obtained were not as satisfactory as the initial drilling led the management to expect. It was thought that the homogeneous diabase formation could be easily penetrated by the diamond drill and good progress was made for the first few days. Then numerous slips and small faults were encountered, forming alternate stretches of hard and soft material, so that progress became slow and it was difficult to obtain a solid core. It will probably be three or four weeks before the crosscut can reach the vein, and the disclosures then made will be of great importance. At the annual meeting of the stockholders held in Globe on Dec. 4, the following board of directors was elected: John H. Rice, William G. Rice, Norman W. Haire, John R. Pimlott and James W. Harrington.

Miami—The fifth unit started on Dec. 1 and production should soon be at the rate of about 2,500,000 lb. of refined copper per month. Installation of machinery and equipment in the sixth and last unit is being effected and this unit should be running early in January, bringing the monthly production of refined copper up to about 3,000,000 lb., based on the present rate of production.

Old Dominion—The November output of the company was 2,060,000 lb. of fine copper. Work is progressing satisfactorily and A shaft, which is the main working shaft, is being sunk to the 18th level. The work of clearing the Kingdon shaft, recently burned out, is underway, and the management has called for bids for a concrete lining for this shaft, instead of timbering. If bids are satisfactory, the shaft will be concreted for 1000 ft. An electric motor was installed on the 16th level in November, for ore haulage, being a duplicate of the one previously placed on the 14th level. The management states that the present year will be the best in the history of the company for low cost of production.

Summit—The following message has been received from W. A. Eaton, of Duluth, Minn., president of the company, by his local attorneys: "Notify at once the directors of the Gibson Copper Co., of my intention to abandon the property, and that they can take possession before the expiration of 30 days." The Summit mine produced copper worth about $1,250,000 under the management of the Gibson Copper Co., and was known as the Gibson mine. In June, 1910, it was bonded to the Summit Copper Co., which worked it until October, 1911. This company was, at the time of closing down, shipping chalcopyrite ore assaying about 20% copper. The Summit officials have issued no statement since the mine was closed down and there is much dissatisfaction among local shareholders, who claim that the funds of the company have not been properly accounted for and that President Eaton and his associates did not take over the stock to which they had subscribed.

Arizona Commercial—Under the reorganization plan there has been deposited a total of 106,697 shares, leaving 13,000 outstanding; this is widely scattered and the committee expects to receive but little of it. Six-months interest on $1,000,000 bonds due Dec. 1 was defaulted and the mortgage has been foreclosed. No bid other than that of the committee is anticipated at the foreclosure sale.

California

Amador County

Plymouth Consolidated—The contract for the top machinery to be installed has been let to the D. D. Demarest Co., at Altaville.

Poundstone—Grading has begun for the site of the new 20-stamp mill which it is reported will be installed.

Kennedy—The 3500-ft. level is reported to be showing well, and the orebody maintains its size and quality; the 100-stamp mill is running regularly.

Butte County

Wagstaff—This old gravel mine, which was a large producer, is to be worked by an underground hydraulic method. A 3-mile ditch carries water from Butte Creek to the mine near Magalia. The mine will be worked through a 400-ft. shaft and two inclines. Levi Cohn is the owner.

El Oro—Employees on dredge No. 2 have for some time been robbing the sluice boxes. Henry Murphy has been

arrested and is said to have confessed, implicating others.

ELDORADO COUNTY

Jasper Independent—The Los Angeles owners of this mine, 10 miles from Shingle Springs, have elected Max Fritsch superintendent. A 6-in. vein of good ore is reported to have been disclosed on the 200-ft. level.

HUMBOLDT COUNTY

Klamath River Mining Company—The installation of a No. 3 giant and 1600 ft. of pipe line with a fall of 300 ft. has been completed at this hydraulic mine two miles above Weitchpec. C. A. Sample, Eureka, is superintendent.

KERN COUNTY

Searles Mining & Milling—This company composed of Los Angeles men has purchased the Bonner & Dexter mine in the Radamacher district, 11 miles north of the Yellow Aster. A stamp mill is said to be contemplated.

International Manufacturing & Mining Co.—Demonstrations under the direction of E. A. Stevens are being made of a dry-washing machine on the placer grounds between Randsburg and Atolia. Both gold and tungsten are reported to be recovered by this process.

LOS ANGELES COUNTY

Red Rover—The mill is being overhauled, ditches cleaned and other surface changes made for reopening this old mine at Acton, which was once a producer, developed by a 250-ft. tunnel and a 535-ft. incline.

MARIPOSA COUNTY

Piñon Blanco—The new mill, of modern pattern and one of the best on the Mother lode, is dropping 20 stamps on good ore, at this mine near Coulterville.

MODOC COUNTY

Lost Dollar—This mining claim in the Hoag mining district, six miles from Hope mountain, has been purchased by E. T. Weisendanger, of Los Angeles, and a contract has been let for sinking a shaft.

NEVADA COUNTY

Contact—A 3-ft. vein is reported to have been cut in this property at Graniteville by Frank Combs, owner. This disclosure is attracting attention from the fact that it is in the same zone as the Bear Creek and the old Von Humboldt in Sierra County.

PLACER COUNTY

Twenty-five miners are working rockers and sluice boxes on Bear river, about two miles from Dutch Flat, earning from $1.50 to $5 per day. Much of this gold is washed from the hydraulic tailings of the mines closed by the Caminetti act.

PLUMAS COUNTY

Deeds conveying mining lands to W. P. Hammon have been filed covering placer mines chiefly in the neighborhood of Quincy.

The California Plumas Railway Company has been incorporated with $500,000 capital stock, of which $27,000 have been subscribed by residents of Quincy and vicinity. The officers and directors are: H. C. Flournoy, president; George Stephan, vice president; W. I. Miller, secretary; A. C. Berg, treasurer; E. M. Cameron, chief engineer. It is proposed to build 27 miles from Sinclair on the Western Pacific, three miles below Keddie, to Big Meadows, touching Indian Falls, Crescent Mills and Greenville *en route*.

SIERRA COUNTY

Rosasco—This quartz property, in Coyote Ravine has been bonded by Gould & Poggi to H. F. Whirlow and associates. Work will be carried on through the winter.

Alaska—The power plant and electric hoist, which were burned recently on this property, at Pike City, are being rebuilt as rapidly as possible. New machinery will be installed soon unless snow blocks the roads earlier than usual.

Larrabee—The owners of this old gravel property, at Downieville, are preparing to open it and to work the channel which it contains. Fred Reichert, of San Francisco, is superintendent.

Gray Eagle—The new electric power plant of this mine, at Gold Point, is completed and the mill will start crushing ore as soon as wires are put up to connect it with the power house. G. A Adams is superintendent.

Four Hills—This mine, eight miles above Downieville, has been bonded to F. H. Wedekind, of San Francisco, who intends to add a cyanide plant to the present equipment of 20 stamps.

Orient—The present force at this mine includes 40 men. The channel developed is over 100 ft. wide with neither rim in sight; the gravel pays well. Hood & Breese have a bond on the property.

Sovereign—The new Beers roller mill at this mine in Ladies cañon has just started crushing the ore which has been stored for over a year. F. O. Richardson is manager.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Princess of India—Charles Lawson, lessee on this Columbia Mountain mine, has commenced stoping on an 18-in. streak of ore which, according to returns from shipments, yields 225 oz. of silver per ton.

American Sisters—At a depth of 335 ft. in the Headlight shaft, a discovery is reported of from 3 in. to 1 ft. of rich silver ore. The mine is equipped with modern machinery and a 50-ton concentration mill, which will be put in order to treat the dump ore, which can now be handled at a profit.

Seven-Thirty—A 6-in. streak of gray-copper ore, assaying 375 oz. silver per ton, has been opened in this vein by I. G. McGuire, lessee, operating through the Hercules tunnel. Johnson & Co., leasing on the second level, have sent out a shipment of ore running 230 oz. silver per ton.

Clay County—This mine is intersected by the National tunnel with its portal below Black Hawk and now in 4000 ft. It starts in the gulch opposite the New York mill and extends into the Lake Gulch district. It cuts the Clay County lode at a depth of 600 ft. below the surface. Several veins have been intersected which show widths of 6 ft., assaying $9 to $12 per ton across the vein.

German—This uranium mine recently opened a new body of pitchblende at a depth of 130 ft. The mine is a gold producer but also produces pitchblende in commercial quantities. H. C. Browne, of Philadelphia, is one of the chief owners and James A. Force, of Denver, is manager.

CRIPPLE CREEK DISTRICT

American Eagles—Two discoveries are reported on the 1100 level; one on the Rice vein shows 18 in. of 3-oz. gold ore, the other on the main Eagles vein, 4 ft. of 2-oz. gold ore. The Colorado Mines Investment Co. is the lessee.

LAKE COUNTY—LEADVILLE

Little Jonny—On the second and third levels of No. 1 shaft, Jones & Stratenberger, leasers, are shipping two carloads per week of 36 per cent. carbonate of zinc ore.

Chippewa—Lessees on this Breese Hill mine have opened a good body of gold and silver ore, and have already shipped several cars.

Discovery—The McClure lease in this shaft on Fryer Hill is shipping lead ore from the 150 level.

Henriette—Improvements and repairs at the shaft have been completed and ore shipments are going out regularly.

Cleveland—The fissure vein of this mine at South Evans is said to have been opened at the 825 level in the granite, and is 30 ft. between walls carrying good gold, silver and lead ore.

New Monarch—From this mine, on Little Ella Hill, a carload of ore per day is going out.

OURAY COUNTY

The old Hill pyritic smeltery at Ouray has been purchased by Thomas B. Crawford and associates, of Denver, and a lead furnace will be added to the present installation. It will be of 50 tons per day capacity and will handle the output of the Guadalupe and Indiana mines of Red Mountain and the Wanakah mines in

the quartzite belt below the town. It is expected to blow in the plant about Jan. 1, 1912.

ROUTT COUNTY

In Browns' Park, in the northwestern corner of the county, 1700 acres of gold placer ground have been filed on by E. J. Longhurst and others, of Vernal, Utah. The gold is said to be coarser than that of the Green River placer belt further south, and the gravel is said to yield 40c. per yard. A test machine of a capacity of 75 tons per day will be installed soon.

SAN MIGUEL COUNTY

Tomboy—During November the mill crushed 7400 tons of ore, yielding $70,500 gross, and net $39,000. Total expenses were $31,500, and $5060 were spent on permanent improvement.

TELLER COUNTY

Ajax—At the end of the first two weeks' operation of the new cyanide mill, at Victor, A. W. Warwick reports that the tailings assay $0.40 per ton. The consumption of chemicals is due mainly to mechanical loss, it is claimed, and the total cost of operation is now estimated at $1 per ton.

Idaho

COEUR D'ALENE DISTRICT

Marsh—The crosscuts from the 600-ft. level of the shaft opened 5½ ft. of ore. At least 2 ft. are of a shipping grade and will average from $70 to $80 per ton. The remaining ore is of a good concentrating grade. The showing is the best which has been encountered in the mine and is a great improvement over the ore found on the 300-ft. level, which heretofore had been the best encountered. The development of the property will be continued. Drifting on the 600-ft. level will not be started until the contract in the shaft is finished, which calls for the opening of the 800-ft. level. The mill will not be started until Apr. 1, 1912. By that time the tonnage opened in the mine and the opening of the three new levels will probably permit production on such a scale as to run the mill at capacity.

Amazon-Manhattan—This company has about two carloads of ore sacked and ready for shipment. This ore is hauled to the Idaho Northern R.R. at the mouth of Beaver Creek. The ore from the Idora and Tuscumbia is hauled out the same way. An agreement has been reached between the three mining companies and the railroad company, whereby the railroad is to be extended up Beaver Creek about 10 miles. This will do away with teaming and will make an easy haul for the railroad, as there will be a down grade from the three mines. In the agreement the mining companies are to do the grading and the railroad company will lay the track and put in all spurs. The road will be finished in the spring and by autumn the three mines are expected to be making large shipments of ore.

Kansas

North Empire—A. M. Gaines, of Galena, has taken over this tract at Galena and is draining the ground. Several leases have been let and two new mills are to be erected.

Michigan

COPPER

Victoria—The cutting of a station has started at a depth of 800 ft. in the new No. 6 shaft. At this point copper rock of encouraging quality was cut.

St. Louis—The temporary surface equipment has been completed and everything is in shape to carry on development work uninterruptedly throughout the winter. Some good rock has been exposed in shaft sinking and the drill cores taken from depth show a like condition.

Winona—The company reports an average yield of 12.8 lb. of copper per ton of rock stamped for the last seven months and for the last three months of that period a yield of 13.5 lb. The mill is stamping about 450 tons of rock per day and is working satisfactorily, conical tube mills having replaced the chilean mills for the grinding of the coarser sands. Operations at the mine are confined to No. 4 shaft of the Winona and No. 1 shaft of the King Phillip, both of which have a large amount of ground opened.

Houghton—The second crosscut to the lode was started recently at a depth of 645 ft. Openings at the level above showed the formation to be of good character and well charged with copper. This company is working supposedly on the Baltic lode.

Hancock—The vertical shaft has gone through the lode, cut at a depth of 3100 ft., and has found it to be about 15 ft. wide and carrying copper in such quantities that it has been decided to open the formation at once. Samples show it to be heavily charged with shot, stamp and small mass copper.

Cliff—This Calumet & Hecla subsidiary is sinking and drifting in its exploratory shaft. A drift is being extended at the 300-ft. level, showing some good ground.

Tamarack—It is reported that a special meeting will be held, Jan. 2, to consider the question of continuing the corporate existence of the company for a term of 30 years. A two-thirds vote of the capital stock is necessary.

Quincy—A director of the company is reported to have stated that the present cost of production is substantially the same as a year ago, 10.474c. per lb., including construction, and that the grade of the mineral is higher.

IRON

Rolling Mill—The Jones & Laughlin company is preparing to sink a new shaft at this mine, near Negaunee.

American—Development operations continue at this M. A. Hanna property, at Diorite. This mine was considered worked out years ago, but a new body of ore was found under the direction of J. R. Thompson, general superintendent. Extensive tracts of land to the west, drilled by George Maas, have been taken over.

Barron—New construction work is underway at this Breitung-Kaufman mine, near Humboldt.

Bates—The company is developing a mine two miles northeast of Iron River.

Munro—An 11x16½-ft. shaft is being sunk by this company three miles east of Iron River.

Zimmerman—The Spring Valley Mining Co. is equipping the new shaft at this mine on the hill east of the Baltic mine.

Wickwire—The company is sinking shafts west and north of the Hiawatha mine.

Iron River Ore Co.—This company is sinking a shaft on the Buckholtz property, west of Iron River.

New York State—Two properties are being developed by this company, north of Iron River.

Stephenson—The Cleveland-Cliffs company has arranged matters so that most of its married employees who were laid off at other properties, recently closed down, are now concentrated at this mine.

Cleveland-Cliffs—The company has stopped all diamond-drill work, except the drill in the west end of the city of Negaunee, which has been running for several years. Some exploratory sandpiping for determining ore formation may be done during the winter, but it is not likely that any new diamond-drill work will be started.

Missouri

McFeran—J. W. Weaver and C. B. Guinn, of Carthage, have bought this mine north of Carl Junction and will erect a new mill on the property.

Hecma—This mine, in the Joplin camp, has been reopened after a long shutdown.

United Zinc—The Chitwood tract of this company, in the Joplin camp, which has been idle for several years, has been leased and will be drained soon.

Oronogo Circle—This company at Oronogo, which has been working a deposit from the surface to 300 ft., has decided to work a part of the ground by the open-pit method.

Lyma—The company is about to erect a new mill on the property at Prosperity. Howard E. Gray, of Joplin, is manager.

Underwriters—This company, operating the Yellow Dog mine at Webb City, has started operations on the old mill on this tract, the 1000-ton mill which the company formerly operated having burned. It has been decided not to erect a new mill.

Ground Floor—Hand jigs are being operated in the ground at the Sheet Ground mine north of Webb City, in making a clean up. This is one of the few instances where jigs have been operated in the ground in this district.

Montana

Butte District

Anaconda—At the Pennsylvania mine approximately 1000 ft. of mining and development work were done during November, consisting of 650 ft. of drifting on the veins, 240 ft. of crosscutting and 110 ft. of raising.

East Butte—A cash payment of $688,758 has been made by the East Butte Copper Mining Co. on its indebtedness incurred by the purchase of the Pittsmont mine and smeltery and notes have been given, bearing 6 per cent. interest and maturing Dec. 1, 1912, for $1,625,574, the balance owed to the Pittsmont company. It was thought at first that an issue of additional securities would be made by the company to meet this debt. With the improvements in the mine and smeltery finished, which should be in a short time, the company will soon be in condition to pay off the notes, as it is now mining and smelting copper at about 8.75c. per pound, which will probably be further reduced by the new improvements. In October with copper at 12.25c. per pound, the company earned $40,000.

Broadwater County

Calumet & Montana—The company is still developing the group of claims taken over last spring and is crosscutting from the lower tunnel to cut a vein. It is reported that the rock is becoming more mineralized. A 300-ft. belt-driven compressor driven by a 54-hp. gasoline engine has been installed. Two drills and two shifts are working and the crosscut is being driven at the rate of 7 ft. per day.

Barnado—The shaft is down about 200 ft. and the company is installing a small belt-driven compressor. With power drills, operations will proceed faster. It is the intention to crosscut to the vein at a depth of between 200 and 250 ft. It is reported that F. A. Heinze has become interested in this group and that with the present development work two diamond-drill holes will be put down, one to intersect the vein at 800 ft. and the other at 500 ft.

Keating—The mine is producing from 100 to 120 tons per day and that is about all the available teams can handle. The vein on the 600-ft. level is wider than on the level above. Mining is in progress on the 400-, 500- and 600-ft. levels and the oreshoot on the 600 is reported to be 4 ft. wide, all of good grade. Preparations are being made to sink another 200 ft. Besides the company's own operations there are leasers working on the south end of the 300-ft. level.

Fergus County

McIntyre—H. H. Lang and associates have suspended work on this prospect. Some high-grade ore was exposed along a porphyry dike.

Cumberland—This mine is being worked by E. B. Coolidge, F. B. Bryant, W. H. Gaines, J. Dimville and S. D. Whipple, who have a lease on the property. The ore is low grade, but can be handled cheaply. Ore averaging $1 can be mined and milled at a profit. This is made possible by open cuts and caved stopes. Practically the entire mine is caved to the 180-ft. level and no work has been done below this. About 100 tons of ore per day are being treated.

Jefferson County

Baltimore—Charles Whitcomb and other Helena men have bonded this mine in Boomerang Gulch, four miles north of Boulder, and mining operations will be resumed there soon in charge of John H. Mulligan. About a year ago a vein 8 ft. wide, carrying gold and silver, was cut on the property, and it is the intention to develop it thoroughly.

Nevada

Comstock Lode

Mexican—The report of Superintendent Symmes, submitted at the annual meeting of stockholders, held on Dec. 5, shows that the ore recovery for the last year, dating from the time the present orebody was uncovered early in 1911, was $412,270. Of this amount, 2678 dry tons of first-class ore were shipped from the 2500 level, averaging $87 per ton, which was shipped to the smeltery, the gross assay value being $233,022 and net $181,130. Out of this sum, one dividend was declared, all operating expense paid and a mill costing $60,000 built and paid for. There is also stored on the surface dumps second-class ore worth $170,000, which will be milled with the starting up for regular operation of the mill this month. The superintendent estimates that there is sufficient ore already developed to keep the mill busy for the next year at the rate of 100 tons per day. This would make the ore opened in the mine worth $1,000,000, with developments in the vein yet to be accomplished below the 2500 level.

Ward Shaft—The diamond drill on the 2200 level penetrated the old bulkhead last week in the Bullion connecting drift and a flow of water was secured averaging 500 gal. per min. The event is one of great importance for the drainage of the Gold Hill mines, and if eventually successful, will open up several hundred additional feet of ground for exploration in the Yellow Jacket, Crown Point and Belcher mines.

Ophir—Smeltery returns on the last shipment of concentrates and bullion from a run of 2000 tons of ore at the mill, gave a net yield to the company over and above freight and treatment charges of $80,000.

Crown Point—Ore extraction has been resumed in the mine, the repairs to the Yellow Jacket, through which operations are carried on, having been completed.

Esmeralda County

Goldfield Consolidated—The estimated production for November is 28,628 tons, yielding $705,000 gross and net, $500,000; operating expenses, $205,000.

Nye County

The camp of Manhattan, 50 miles north of Tonopah, is attracting attention through its rapidly increasing output from numerous leases. The Big Four lease has produced over $300,000 from ore taken out to a depth of 400 ft. The White Caps, developed to a depth of 200 ft., has milled over 800 tons, and has 1500 tons more ready to mill. Tonopah men are now building a 10-stamp custom mill and sampling plant.

Tonopah Extension—The company has paid off the final installment of its bonded indebtedness and has a surplus in the treasury. The 30-stamp mill is treating 145 tons of ore per day, of an average grade of $13 per ton, the net profits averaging $23,000 per month. The output for November was 4362 tons of ore, averaging $12.15 per ton, yielding approximately $51,000 gross, and net $25,000.

Gypsy Queen—The controlling interest in this company has been acquired by San Francisco men. The property adjoins the North Star mine on the north, and it will be developed by a crosscut from the 1250-ft. level of that mine.

West End—The 20-stamp mill is treating 80 tons of ore and 75 tons of old tailings per day and is making net profits of from $15,000 to $17,000 per month.

White Pine County

Giroux Consolidated—Work is confined to the operation of the bailers, in the Giroux shaft, and the surface work near the Morris No. 2 shaft. In the Giroux shaft the water has been lowered to a point 70 ft. below the 1200-ft. level. There being only a limited amount of development below this point, the inflow will be derived from the saturated area tributary to the shaft. The bailers, holding about 2000 gal. each, are working satisfactorily and it is proposed to unwater the shaft as completely as possible with them before starting the pumps. The station pumps on the 1200-

ft. level were found in good condition and can be started at any time. At the Morris No. 2 shaft about 100 men are grading for the sidetracks and engine and boiler houses. The head frame is about one-third completed. It is the one used temporarily at the Giroux shaft and afterward replaced with the 95-ft. steel structure. Exploration is being continued with two churn drills, working double shift. One of them is sinking on the Butte & Ely property, adjoining the Liberty pit of the Nevada Consolidated; the other one is at the west end of the Morris orebody.

Nevada Consolidated—At the Veteran mine the shaft was found to need only slight repairs, which have been completed, and it is expected that the mine will be producing again in about 10 days. It is reported that a strike of churn-drill men at the shovel pit at Copper Flat has caused some delay in this work. The drilling is well ahead of shovel requirements, and no decrease in ore output is expected.

New Mexico

Little Fanny—As a result of a missed hole, two men were killed recently and five injured at this mine, in the Mogollon district.

Albert—Contractors are driving a drift on the Independence, Jr., vein.

Deadwood—In addition to its own ores the mill is handling a quantity of custom ores. At the mine, drifts are being extended north and south on the 200-ft. level. A south drift on the 300-ft. level is advancing about 75 ft. per week.

Oaks—The Pacific tunnel is being advanced and the north and south drifts on the 100-ft. level of the main shaft are being extended. The ore extracted in development is being treated at the Deadwood mill. The new power plant will be completed as rapidly as possible.

Ernestine—During the second 10-day period of November, the mill produced 8500 oz. of gold and silver bullion and 10,000 lb. of concentrates. An option on the property, given recently to A. Chester Beatty, of New York, and other Eastern men, expired Dec. 11. It is stated that nothing has resulted from the negotiations.

Oklahoma

George W. Moore, of Webb City, Mo., is sinking a shaft on his 40-acre lease in the north end of the Miami camp.

Miami Concentrating Co.—This company, operating the King Jack mine at Miami, has installed a new compressor in the mill and is preparing to take up a 10-ft. stope throughout the old ground. The company has also drilled a hole showing the deep run of ore.

Chapman & Lennan—This company, of Webb City, Mo., is sinking two large shafts to the deep ore in the north end of the Miami camp.

Oregon

Gold Drift—This mine, in Josephine County, has been bonded to McCorkle Bros. and W. B. Sherman, of Grants Pass, who are making plans for operations on a larger scale.

Blue River—Operations at this mine, in Lane County, are to be resumed, and a new concentrator is to be installed. Charles A. Phelps, Los Angeles, is interested.

Tennessee

Anderson County

Knoxville Iron Co.—On the morning of Dec. 9, an explosion occurred at the coal mine operated by this company at Briceville, 34 miles from Knoxville. Conservative estimates place the number of men originally entombed at 150. Three mine-rescue cars were sent to the scene and the latest available reports state that three men escaped at the time of the explosion; five more have since been taken out alive from some of the inner workings and 31 bodies have been removed. It is estimated that a total of 84 men were killed.

Utah

Beaver County

Moscow—From four to five cars of ore running beween $25 and $30 per ton are being shipped monthly, and bring net smeltery returns of over $6000. Ore is being mined from the 600-ft. level and above. The main working shaft is down 400 ft., and a winze has been sunk from this level in ore for 200 ft. On the 600, drifting to the north has been done for 161 ft. in ore of shipping grade. A new oreshoot has been opened by a series from the 400.

Sheep Rock—It is reported that the Robinson lease has been renewed for another year under slightly different conditions, more development work being required. The ore on the 50-ft. level runs well in gold. A car is nearly ready for shipment.

Horn Silver—Four sets of leasers are working and are reported to be successful. About 1000 tons of ore per month are being shipped from the property by leasers and on company account. There was a contest for control at the annual meeting held in Salt Lake City, Dec. 5. The new board of directors is composed of the so called "insurgents." These will soon organize in New York and will outline the future policy of the company. Shipments were made during 10 months of the last year and about 5000 tons of silver, lead and zinc ore were marketed. The new board consists of E. B. Critchlow, M. C. Morris, H. S. Young, A. B. Simonds, J. Neadle, E. F. Emmet, E. E. Olcott, W. R. Britton and C. Brennermann.

Juab County

Iron Blossom—A full face of copper ore has been opened on the 600-ft. level and 125 tons were shipped recently. It is expected that the mine will be producing a good tonnage of this ore in a short time. A deposit has been developed to the south of the No. 1 shaft on the 600-ft. level and there is a large stope midway between the north and south workings.

Colorado—The report for the year ended Nov. 1, 1911, has been issued. Operations have been confined chiefly to mining known orebodies and to prospecting on the 300-ft. level along the channel already mined. Several new orebodies were discovered through this work during the year. Little prospecting in new territory has been done, as neighboring properties are doing work at deeper levels, and any favorable discoveries in these properties would benefit the Colorado. In order to provide working capital for development the dividend has been reduced and a substantial surplus maintained, the year having closed with a cash balance of $110,748. Shipments amounted to 19,210 tons dry weight, the net value of which was $313,541, or $15.66 per ton.

Eureka-Swansea Extension—This property is being developed from the 2000-ft. level of the Opex; the drift on this level has reached Eureka ground, and it is expected that the limestone-quartzite contact will be cut in about 200 ft. Drifting along the contact will be done.

Union Chief—The tunnel is headed for the orebearing limestone, from which high-grade ore was taken out in surface workings.

Summit County

Park City shipments for the week ended Dec. 2 were as follows: Daly West, 1,825,340 lb.; Silver King Coalition, 1,339,760; Daly-Judge, 1,018,000; Little Bell, 68,000; Silver King Consolidated, 64,000; total, 4,316,100 pounds.

Daly-Judge—During the last eight months the company has netted an average of $16,032 per month, and for the last three months, $23,630. On Nov. 1, 1911, there was $421,235 in the treasury. The mine is said to be in a condition to justify regular quarterly disbursements. It has been reported that 150 Austrian miners employed will be replaced by Americans.

Columbus Consolidated—Ore running $40 to $60 per ton is reported to have been opened for 30 ft. in the Brain fissure on the main-tunnel level; there are 18 in. of this ore in the face.

Giles—Samples of ore showing peacock copper have been received from the

new tunnel, which is in 170 ft. Four men are at work and it is the intention to put on larger forces and to continue operations through the winter. The property is between the Park City and Cottonwood districts. H. L. Giles is president.

Washington

White Elephant—Frank Ansley, Orient, manager of this mine in Ferry county, has a crew at work sinking a shaft. The company contemplates the installation of a stamp mill next spring.

Kate Hayward—The property in the Republic district has been sold to the St. John Mining and Milling Company, of Spokane, and considerable development work is being planned. J. W. Lloyd, Republic, is in charge.

Falls City Mining & Milling—This company has taken over the Diamond R., Diamond R. No. 2, Bella May and two fractions of the Blue Bucket claim, in the Metaline district in Stevens County, formerly owned by William Kroll, of Spokane, and development will be pushed.

Canada

British Columbia

Rambler-Cariboo—One of the best shoots of ore yet found in this Slocan mine has been opened on the 1200-ft. level. The adit has been in this oreshoot for 120 ft. and there is still a full face of ore. An average sample taken here recently gave an assay return of 96 oz. silver per ton and 70 per cent. lead. There is also much ore on the 1000- and 900-ft. levels; the only stoping done on the lower levels has been on the 1000-ft., where 10 ft. of ore have been taken out. A little ore has been found on the 1400-ft. level, which is being driven to cut oreshoots believed to occur ahead.

Ontario—Cobalt

La Rose—Rich ore is being taken from the new oreshoot on No. 8 vein on the Lawson property. It is stated that six tons of this ore averaged 9100 oz. per ton.

Dominion Silver—Sir Henry Pellatt, of Toronto, has acquired a 3-months option on this property in North Cobalt, on which but little work has been done. Operations will be commenced soon with Manager Gordon, of the Cobalt Lake company, in charge.

Buffalo—A fatal acident occurred at this mine on Dec. 6. A drill struck a hole containing an undischarged shot, which exploded, killing W. Rheaume and injuring three other workmen.

Nipissing—During November the net production amounted to $225,907. The shipments totaled $248,980, of which $99,407 were from ore and $158,573 were in bullion from the high-grade mill.

Canadian-Gowganda—A carload of 50,000 lb. of high-grade silver ore is being teamed from the mine to Charlton, on the Temiskaming & Northern Ontario Railway.

Ontario—Porcupine

Dome Extension—The main shaft is down 200 ft., and as soon as a sump has been cut, a crosscut will be run to intercept the main vein.

Dome—The rich sample from the "golden sidewalk" has been shipped to the Bureau of Mines, at Toronto. Several more diamond drills are to be started on the property.

Rea—The grade of the ore on the 300-ft. level of this property is disappointing.

Murphy-Mitchell—These claims, in Carscallen Township, have been optioned to a French syndicate.

Miller-Middleton—A crosscut at the 65-ft. level has opened up a good body of milling ore.

Bouzan—These properties are being developed by the International Gold Syndicate.

Gold Pyramid—This Munroe Township property will install five more stamps.

Miller-Porcupine—A plant will be installed on this property.

Imperial—At the annual meeting it was shown that the company has $3959 and 648,000 shares of stock in the treasury.

Lucky Cross—The shaft of this Swastika property is down 50 ft. and shows free gold most of the way.

Martin—A contract has been let for 2000 ft. of diamond drilling.

McIntyre—Good ore has been encountered at the 200-ft. level in a crosscut driven 35 ft. from No. 1 shaft.

Standard—Diamond-drilling operations having yielded satisfactory results, a 12-drill electrically driven compressor and other equipment have been ordered.

Pike Lake—A shaft is being sunk on the Reeves vein on this property at Swastika.

Pearl Lake—Diamond drilling to a depth below 1100 ft., the greatest reached in the camp, has yielded good results. Six samples, taken between 1162 and 1182 ft., show gold contents ranging between 40c. and $20. Some sludge samples, taken between 1170 and 1200 ft., run from $3.60 to $8.40.

Ontario—Sudbury

The Canadian Northern R.R. has started construction of its line from Sudbury to Ottawa and Montreal, which leaves the Toronto branch at a point about 20 miles north of Sudbury. This junction is known locally as Vermilion City. It is expected to have the line in operation in about two years.

Dominion Nickel—Diamond drilling is being carried on actively at the Mt. Nickel mine, and more drills are being added to hasten development.

Mexico

Chihuahua

Veta Grande—The warehouse of this company was broken into recently and mining supplies, including fuse, powder and caps, were stolen.

Alvarado—The new thickeners and classifiers which were recently ordered for the mill, have arrived and the tube mills which are to be added to those already installed are expected soon. With the present equipment the mill is said to be running nearly up to capacity. Oscar Langendorf is in charge.

Arizona-Parral—This company, owning the El Tajo mine and mill, has resumed work at the mill. Oil burners have been installed under the boilers and are giving satisfactory results.

Santiago—It is reported that work will be resumed on this property in the Santa Barbara district and at the Porvenir mine, near Palmilla. N. T. Wilson, of Denver, Colo., is interested in these properties.

Mexico

El Oro—During November, the mill crushed 30,070 tons of ore, yielding 190,660 gross, and net $77,430. Operating expenses were $101,000, and $12,230 were spent on development. Expenditures on permanent improvements amounted to $21,430. Total profit, including railway, was $85,190.

Sonora

Chispas—This mine near Arizpe is reported to have closed down because of the strike which started about a month ago. Work is confined to pumping.

Greene-Cananea—During November the company produced 3,632,000 lb. of copper, 121,326 oz. of silver and 622 oz. of gold.

Minneapolis Copper Company—The property of this company is near Cumpas. Work is to be started immediately, and it is expected that about 40 men will be employed. Work was done at this property previous to the recent revolutionary disturbances.

Riveria—This mine is being developed by George J. Cole. A rich strike was made a few days ago and a carload of ore will be sent to the El Paso smeltery.

Sierra Colorada—This mine, near Carbo, is being developed. The shaft is now 200 ft. deep and it is estimated that about $300,000 worth of gold and silver ore has been blocked out.

Amarillo—A cyanide plant has been recently erected at this mine, near Carbo.

Central America

Nicaragua

Panama Mining Co.—The first shipment of gold bullion to the United States is reported to have been made on Nov. 5, 1911.

The Markets

Coal Trade Review

New York, Dec. 13—Coal-trade conditions show no material change from the last report. The bituminous trade, both East and West, is gradually improving under a better demand for steam coal. Anthracite trade is strong and active, and production continues large. The coastwise trade is suffering from short supply of vessels and consequent high rates.

At a meeting held in Chicago last week, on a call issued by the Illinois Coal Operators' Association, representatives were present from Indiana, Michigan, Illinois, Iowa, Wyoming, Montana and the Southwest. Resolutions were passed in favor of the formation of a national association of operators, chiefly for the purpose of securing united action on the labor question. A committee was appointed to draw up a constitution and to report to another meeting, to be held Dec. 18. H. N. Taylor, president of the Illinois Association, is at the head of the committee.

Anthracite shipments in November were 6,133,314 long tons, being 135,865 tons less than in October, and 61,568 tons more than in November, 1911. For the 10 months ended Oct. 31 the total shipments were 58,674,208 long tons in 1910, and 63,838,872 in 1911; an increase this year of 5,164,664 tons, or 8.8 per cent.

A deal affecting the anthracite trade is announced this week. The New York, New Haven & Hartford Co. has sold the controlling interest in the New York, Ontario & Western R.R., which it had owned for several years, to the New York Central & Hudson River Co. This gives the New York Central for the first time a direct entrance into the anthracite field. The equivalent is part in cash and part in the control of the Rutland R.R., which rounds out the New Haven system in northern New England, and gives it a line of its own into Montreal. The Ontario & Western handled last year from its controlled mines 2,772,547 tons of anthracite or 4.3 per cent. of the total shipments. A large part of this coal went to western and northern New England over the New Haven's Poughkeepsie Bridge line. Doubtless these shipments will be continued, under some form of traffic agreement. The New York Central's control of an anthracite road is not likely to make any immediate changes in the trade, though its possession of such a line will give it a voice in the councils of the trade.

German Coal Production—For the nine months ended Sept. 30 the German Empire produced 119,791,173 metric tons of coal and 53,352,999 tons of brown coal or lignite; a total of 173,144,172 tons. As compared with 1910 there were increases of 7,050,907 tons of coal and 3,422,392 tons of brown coal; a total gain of 10,473,299 tons. Coke made was 18,665,724 tons, an increase of 1,314,181 tons. Coal briquets made were 3,740,450 tons, an increase of 452,644 tons; brown coal briquets made, 12,299,365 tons, an increase of 1,220,518 tons.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

IRON·TRADE·REVIEW

New York, Dec. 13—The iron and steel trades continue to show a large volume of business and a tendency to place contracts further ahead. The latter is not specially encouraged by manufacturers, owing to a growing belief that the bottom level of prices has been nearly reached, and that advances may soon develop. An increase in bar prices, indeed, was noted last week; and this week the leading producer has given notice of an advance of $1 per ton on wire. The general belief is that this advance can be held, as the demand continues good. Competition is still strong, however, and most mills are able to take more work, though as a rule they are in much more comfortable position than they were two or three months ago. November was, undoubtedly, the best month of the year in volume of orders, and a turn in the market may well be at hand, though it will hardly come before the new year. Meantime, we do not hear anything of a return to controlled prices.

Finished-material orders continue to come in fairly well in most lines. Railroads are buying more. Besides the car orders already noted, a good lot of bridge work has been placed. Rail orders for 1912 are coming out, the latest being one for 30,000 tons placed with the Colorado Fuel & Iron Co. A number of smaller orders are forward.

The activity in pig iron has moderated slightly, though there is still a good deal of buying. Southern iron is rather firmer and sales below $10 at furnace are now the exception rather than the rule. There has been no advance at Northern furnaces, but the tone is firmer than it has been.

The United States Steel Corporation reports the total unfilled orders on the books, Nov. 30, at 4,141,955 tons. This is an increase of 447,627 tons over Oct. 31, and is the heaviest tonnage reported at the end of any month since June, 1910. It is 1,031,036 tons greater than January last, which was the lowest report this year.

Pig Iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age*, show that on Dec. 1 there were 211 coke and anthracite stacks in blast, having a total weekly capacity of 66,600 tons; a decrease of 200 tons from Nov. 1. Since August the fluctuations have been small. Making an allowance for the charcoal furnaces, the estimated total production of pig iron in November was 2,026,200 tons; for the 11 months ended Nov. 30 it was 21,598,050 tons.

Baltimore

Dec. 11—Exports for the week included 332 lb. selenium and 112,018 lb. zinc to London; 5,477,494 lb. structural material and 4,865,919 lb. miscellaneous iron and steel to Panama. Imports included 2725 tons ferromanganese from Great Britain; 30,400 tons iron ore from Cuba; 5617 tons pyrites from Huelva, Spain.

Birmingham

Dec. 11—A big tonnage of pig iron has been disposed of again during the last week and the price of the product has taken on strength, $10 per ton, No. 2 foundry, being the minimum and $10.25 being obtained for a quantity of the iron sold. The stocks of iron on hand have been reduced of late and the general conditions are more favorable than they have been. Southern furnace companies have sold several hundred thousand tons of iron ahead for delivery during the coming year, the greater portion during the first half. There will be no curtailment in the iron production for some time to come now, as the sales made warrant a continuance of operations.

The steel situation remains unchanged except as to future prospects. The Tennessee company looks forward to some good orders for rails and fabricated steel. Two orders, for 60,000 tons of rails in all, were booked in the last 30 days, the delivery, however, to cover a long period in 1912.

Charcoal iron is in fair demand, $22 and $22.50 per ton being the price.

Alabama pig-iron output in November was 156,436 tons and a similar aggre-

gate is looked for in December. Some furnace records were broken during the past month. Five furnaces of the Tennessee company at Ensley produced something like 56,000 tons of basic iron. The Sloss-Sheffield company produced with one of its small furnaces at North Birmingham 7444 tons of iron.

Chicago

Dec. 12—Buying of pig iron undoubtedly has increased in the last week, though it is not yet up to any proportions that signify a change in the spirit of the chief consumers in this market, the foundrymen, to buy largely in advance of actual needs for the next three to four months. A few contracts for tonnage in excess of 2000 tons each have been placed; the average order continues a carload to 1000 tons—in expectation of the needs of the first quarter. Few melters are buying into the second quarter.

There is a feeling in producing and consuming circles that the time for change is ripe, but it has not come, on a broad view. But the buying movement is growing larger, because of gradually increasing needs and long delayed requirements.

Under these conditions Southern No. 2 brings $10@10.50, at furnace, or $14.35 @14.85, Chicago. Northern No. 2 brings $14@14.50, with the price about the same for early delivery or in the first quarter. Lake Superior charcoal, steady and apparently with no surplus production, brings $16.50@17 per ton.

In the iron- and steel-material market, structural steel continues to develop little business, because of the weather, though there are many indications of large prospective building operations. Bridge business is quiet. Bars show activity as regards the local mills and the effort of the independents to hold the price of steel bars to 1.10c., Pittsburg—equivalent to 1.28c., Chicago—may succeed, though some sales are being made at 1.23c. Sheets are dull, at 2.03@ 2.08c., and plates mildly active at 1.30 @1.35c. The railroad interests are buying lightly, as they find they must buy, but a little more business developing on this account. General signs are encouraging, in view of the upward tendency of business generally.

Cleveland

Dec. 11—The total Lake ore movement for the season, which closed Dec. 1, was 32,130,411 tons, being a little larger than was generally expected. It was less than 1910 by 10,489,790 tons, or about a quarter. Nearly all the ore has been carried by the regular lines, and wild boats have hardly earned their keep.

Pig Iron—Buying has slowed down a little, but is still pretty active. Prices have not changed. For Cleveland delivery, bessemer is $15@15.15; No. 2 foundry, $13@13.25; gray forge, $12.50. Sales of basic are reported at $12.30@ 12.40 at furnace.

Finished Material—The advanced quotations on bars are taken as the forerunners of other rises, but makers do not seem to be able to force them. However, there is a good run of business, and specifications on contracts are coming in freely.

Philadelphia

Dec. 13—Heavy dealings in pig iron are reported by all agencies and makers. The demand covers all kinds from foundry to basic. The largest local purchase was 11,000 tons for locomotive purposes; the next, 5000 tons for machine-shop use, beside sales of 30,000 tons which will probably reach 40,000 tons before the close of the week for low-grade iron for cast-iron pipe. The mill people have at last begun to order forge for forward delivery in some cases as far as April. Furnace stocks are steadily disappearing. Steel-making grades are dragging somewhat, though inquiries and negotiations indicate an early and pronounced improvement. Basic has been ordered more freely and inquiries are on the market today indicating large early transactions. In some quarters an upward tendency is predicted. Business in low-phosphorus iron that has been hanging for some time was suddenly closed late last week. Quotations for No. 2 X foundry are $15.25, with sales of No. 2 plain at $14.75. Southern foundry offers no price inducements. Gray-forge sales are frequent at $14.25 and basic is strong at $14.50, with $19.25 for low phosphorus.

Steel Billets—Sales of billets have fallen below the amount indicated by inquiries last week. Consumers are slow in placing orders.

Bars—The bar mills are booking more orders than usual for early delivery at fractionally higher rates and have the option of accepting larger business for winter delivery.

Sheets—All reports from the sheet mills indicate a further increase in postponed deliveries; most small buyers are supplied for the present.

Pipes and Tubes—Under the revised quotation business has improved this week, in large orders for deferred delivery.

Plates—The influx of business in steel plates continues. One reason for the hurried orders is the necessity for taking advantage of recent prices named. Plates are now quoted a little higher than even a week ago, but most of the business sent to miills has been at the former figure.

Structural Material—Pennsylvania makers have secured an encouraging volume of business within a week, involving deliveries in some cases as remote as the Pacific Coast. Not a little business is still hanging fire, as buyers are insisting on quotations two weeks old.

Scrap—The higher grades of scrap have come in for their share of activity. Stocks have been depleted in several of the larger yards and in consequence railroad scrap and No. 1 wrought yard scrap are quoted 50c. higher. Old iron rails are being picked up more actively than for some months. Wrought turnings and cast borings are also selling better than for some months.

Pittsburg

Dec. 12—Superficial indications, at any rate, are of a distinct upward trend in finished-steel prices. Following the announcement of the Republic Iron & Steel Co., of Nov. 29, that its minimum prices on steel bars were advanced $1 a ton, to 1.10c. for prompt and 1.15c. for contracts over first quarter or first half, the following events have occurred: Other producers of steel bars made similar advances; special prices on plates and shapes were withdrawn, making the minimum of the market practically the 1.10c. price which had formerly been done on ordinarily attractive business, special lots being taken at 1@1.05c.; the American Steel & Wire Co., on Dec. 11, announced an advance of $1 a ton in its prices, making nails $1.55, plain wire 1.35c., painted barb wire 1.55c. and galvanized barb wire 1.85c., the independents as a rule advancing their own prices as soon as they heard of the leading interest's advance; the majority of the lowest sellers in the sheet market withdrew their special prices, the American Sheet & Tin Plate Co., on Dec. 11, advancing its quotations by a still larger amount, to 1.90c. for black and 2.90c. for galvanized sheets.

Thus five important steel products have advanced in price, the three remaining products of consequence being rails, which have not changed in price for a decade; tinplates, which are unchanged, and merchant pipe, which was formally reduced $2 to $4 a ton, Dec. 1, but simply in recognition of cutting which had been going on for perhaps a fortnight or more. Whether the advances will hold is another matter; the feature of the market is that in the past fortnight the whole tendency has been an advancing one.

An evidence of the heavier bookings of business in the finished-steel trade is furnished in the fact, hinted at in last report, that the Jones & Laughlin Steel Co. will start the steel-making department at its new Aliquippa works about Jan. 1. The wire and tinplate departments at this plant have been in steady operation, and the four blast furnaces were operated for a short time in 1909-10, but the steel department, comprising four 250-ton Talbot openhearth furnaces, has never been operated. The company has been a heavy

buyer of heavy melting steel scrap, paying $12.50@13 for 30,000 or 40,000 tons, chiefly for Aliquippa delivery, and last week closed for 40,000 tons of basic pig iron on the basis of about $12.10@12.15, Valley, with a freight rate of 60c. to Aliquippa, for very early delivery. The intention is to start the steel works without the blast furnaces, as it is uncertain how long the steel plant will operate, and pig iron can be bought at practically the cost of production. The plant can produce about 40,000 tons of steel ingots monthly, supplying the finishing departments.

Pig Iron—The Jones & Laughlin purchase of 40,000 tons of basic iron was made from three or four sellers. The basic market immediately stiffened, and a sale of 1000 tons or more was made to a relatively small consumer at $12.50, Valley. Sales of foundry iron have been heavier in the past week or 10 days, the better demand bringing out lower prices, as $13, Valley, has been done freely, a decline of 25c. from the price which held for many weeks. A sale of malleable, 1.25 per cent. manganese is reported at $12.75, Valley, for eastern shipment. We quote: Bessemer, $14.25; basic, $12.50; No. 2 foundry, $13; malleable, $12.75@13; foundry, $12.50@12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—A sale of 300 tons of ferromanganese for first-half delivery has been made to a Pittsburg district steel interest, and several single carloads for prompt and near forward delivery, all this business being at $38.50, Baltimore, which now seems to be well established as the market. We quote the market at $38.50, Baltimore, for prompt and forward.

Steel—The mills have been booking a large tonnage not only for December shipments, but also for January and in a few cases for February, and being in quite comfortable position have stiffened up their prices by 50c. to $1 a ton. The lowest prices are made f.o.b. Youngstown mill, Pittsburg prices being higher, though not to the full extent of the $1 freight. We quote, f.o.b. Youngstown mill: Bessemer billets, $19; bessemer sheet bars, $19.50; bessemer and open-hearth billets, delivered Pittsburg, $19.50; bessemer and openhearth sheet bars, delivered Pittsburg, $20. Wire rods are nominal at $26, Pittsburg.

Sheets—The market has been stiffening steadily. Last week the majority of the lowest sellers among the mills withdrew their lowest quotations. In some cases sheets had been sold for prompt shipment down to 1.77½c. and 1.75c., while contracts for the first six months of the new year were made at 1.80c., galvanized sheets being $1 per 100 lb. higher. These were extreme prices, not done generally. By the withdrawal of several mills the market advanced slightly, so as to be quotable at 1.85c. for black and 2.85c. for galvanized, 28 gage. Yesterday the American Sheet & Tin Plate Co. is understood to have withdrawn all its quotations under 1.90c. for black and 2.90c. for galvanized, and the effect of this action upon the market will be watched with interest.

St. Louis

Dec. 11—The pig-iron market has been in fair shape for the past week, though mostly confined to small contracts. Business seems to be a trifle slower and will probably not show any change until after the holiday season. It is thought that after the first of the year a number of buyers will be in the market for both spot and future iron. The price of $10, Birmingham, for No. 2 foundry, or $13.75, St. Louis, remains unchanged.

Northern iron has been a little stiffer in price, though very little has been sold on the St. Louis market.

METAL MARKETS

New York, Dec. 13—In part the metal markets have been much excited. The chief incident has been the break in the spelter market, which was inevitable under existing conditions.

MONTHLY INDEX NUMBERS

Month	1910	1911	Month	1910	1911
January....	127	110	July.....	112	112
February ..	124	115	August.....	113	117
March.....	118	112	September.	114	111
April.....	118	114	October....	111	112
May.....	113	118	November .	117	111
June.....	107	115	December..	115	.....

Year 1909, 115; 1910, 115.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Oct. 1911..	$3,983,994	$ 4,102,427 Imp.	$ 118,433
" 1910..	750,330	4,250,259 Imp.	3,499,929
Year 1911..	22,247,304	49,279,533 Imp.	27,032,229
" 1910..	56,068,411	49,932,386 Exp.	6,136,025
Silver:			
Oct. 1911..	5,087,087	3,404,458 Exp.	1,682,629
" 1910..	4,269,575	3,395,200 Exp.	874,375
Year 1911..	54,615,048	37,100,888 Exp.	17,514,160
" 1910..	46,034,318	36,652,464 Exp.	9,381,854

Exports from the port of New York, week ended Dec. 9: Gold, $267,745, chiefly to South America; silver, $1,459,325, principally to London. Imports: Gold, $170,400; silver, $90,756 from Mexico and South America.

Gold—The price of gold on the open market in London remained at the normal level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold was taken for India, but most of that arriving went to the Bank of England.

Iridium—The price continues steady, $64 per oz. being asked for pure metal.

Platinum—The market is quiet and prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal. The foreign market is steady.

Silver—The market continues quiet; demand more limited, buyers more easily satisfied. Shorts have apparently covered, so that for the present the difference between spot and future is likely to be much less than the figures which have been prevailing for a month past.

SILVER AND STERLING EXCHANGE

Dec.	7	8	9	11	12	13
New York....	55⅜	55⅛	55¼	55	55¼	55
London.....	25 7/16	25⅝	25⅜	25⅛	25⅛	25⅛
Sterling Ex..	4.8595	4.8575	4.8575	4.8600	4.8615	4.8635

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to Nov. 30, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India.....	£6,555,600	£8,067,700	I. £1,512,100
China.....	1,328,500	990,300	D. 338,200
Total.....	£7,884,100	£9,058,000	I. £1,173,900

India Council bills in London averaged 16.08d. per rupee for the week.

Stocks of silver in Shanghai on Nov. 30 were 28,350,000 taels—or $16,272,900—a reduction of $1,808,100 during November.

Copper, Tin, Lead and Zinc

NEW YORK

Dec.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
7	13.25 @13.30	12.95 @13.05	44¾	4.45	4.30 @4.35	6.30 @6.35	6.15 @6.20
8	13.25 @13.35	13.05 @13.10	44⅝	4.45	4.30 @4.35	6.15 @6.27½	6.00 @6.12½
9	13.25 @13.35	13.15 @13.25	44¾	4.45	4.30 @4.35	6.15 @6.27½	6.00 @6.12½
11	13.37½ @13.50	13 25 @13.35	43¾	4.45	4.30 @4.35	6.15 @6.27½	6 00 @6.12½
12	13.50 13.62½	13.35 @13.45	43⅞	4.45	4.30 @4.35	6.15 @6.27½	6.00 @6.12½
13	13.50 @13.75	13.45 @13.50	43¾	4.45	4.30 @4.35	6.15 @6.27½	6.00 @6.12½

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—On Dec. 7 there were some large sales of electrolytic copper at 13c., and some considerable transactions were made as low as 12.95c., cash, New York. It seems, indeed, very strange to report that just before the most important advance which has taken place in the copper market in any one week for upward of

LONDON

Dec.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
7	58 5/16	59 1/16	62¾	203½	192	15¾	26⅞
8	58 1/16	59 1/16	63	202½	191½	15¾	26⅞
9	.....	.....	.....	.....	.....	.....	.....
11	59	60⅛	63½	198	188½	15 13/16	26⅞
12	60½	61 5/16	64¼	198½	189½	15⅝	26⅞
13	60	61 5/16	64¼	198	190½	15½	26⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17¼c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

a year, there was such free selling on part of speculative interests at prices which represented a reduction from the quotations ruling during the previous week. Although the quantity so offered was relatively large, it found a ready market, so that the disturbance which these low prices created was practically confined to a single day. This was also due to the fact that the statistics published on Dec. 8 gave the market an extraordinary stimulus and particularly on account of the heavy demand which the information created in Europe from all interests. Buying, especially for export, took place on an old-fashioned scale, and as the quantities in first hands, especially electrolytic, to judge from the statistics must have been reduced nearly to a mere working basis, it is not surprising that prices should have been raised from day to day. There has also been a fair business doing for home trade, but by no means of any such proportion as might have been expected, considering that consumers are not supplied very far ahead. Some observers believe that there is at last beginning to be a general realization that the output of the new mines will not swamp the market, but, on the contrary, may be needed, and in consequence a higher level of copper prices is justified.

However that may be, an increased feeling of confidence is certainly now manifest. The sharp advance in the market during the week of Dec. 7-13 was naturally accompanied by a good deal of excitement. The latter condition has led to a rather wide variation in prices, not only between beginning and end of the same day, but also at the same time. On Dec. 12 all of the agencies had raised their price for electrolytic to 13⅝c., delivered, usual terms, corresponding to about 13.45, cash, New York, and copper was obtainable at that price on Dec. 13, though nearly all of the agencies were then asking 13¾c., delivered, usual terms. At the closing of this review no sales had been reported at that price, but the tone of the market indicated that it would soon be realized. The close is firm for Lake copper at 13½@13¾c., and electrolytic copper in cakes, wirebars and ingots at 13.45@13.50c. Casting copper is quoted nominally at 13@13¼ cents.

An active speculation took place in the standard market, the fluctuation of which followed closely the movement in refined sorts. The high point was reached Wednesday morning, the 13th inst., when spot ruled at £60 17s. 6d., and three months at £61 15s. The close is slightly reactionary, at £60 11s. 3d. for spot, and £61 8s. 9d. for three months.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire has again been advanced, to 14¾c. base, carload lots at mill.

Copper exports from New York for the week were 9973 long tons. Our special correspondent gives the exports from Baltimore at 4294.

Tin—The London market became rather soft during the last week. Sales of futures amounted to fair quantities, while in spot tin only trifling transactions took place. From this it seems that the Syndicate desires to see the market lower, without sacrificing any of its spot holdings. What the Syndicate's motives are can only be guessed at, but it may want to accumulate future tin for the purpose of controlling the situation when the bears have to cover their short sales made in anticipation of the new tin contract of the London Metal Exchange.

Little business is reported by the domestic trade. Notwithstanding larger shipments from England, spot tin remains scarce and at a premium. The markets close at £198 for spot, and £190 10s. for three months, and at 43.75c. for December tin in New York.

Lead—The market is unchanged at 4.45c., New York, and 4.30@4.35c., St. Louis.

The London market is easier, the close being cabled at £15 10s. for Spanish lead, and £15 12s. 6d. for English.

Spelter—The uncertain situation of this market at the close of our last week became clarified on Dec. 7, when some transactions were made at 6.17½, St. Louis, followed by offerings at reductions from that price. Since then the market has been nominal, but has stood at a lower level, owing to the offerings. Bids have been made at 6c., but none of the smelters has been willing to accept that price. The developments of the week indicate that considerable spelter was held back from the market, thus contributing to create the situation of which there has been so much discussion during recent weeks. When holders tried to dispose of their metal, they did not find any market to speak of. The level which was reached during the last week is more reasonable, and there is some indication that the market may steady around the closing quotations, which are nominal at 6@6.12½, St. Louis, and 6.15@6.27½, New York.

The London market is steady at £26 17s. 6d. for good ordinaries, and £27 2s. 6d. for specials.

Zinc dust is quoted at 7¾c. per lb., New York.

Base price of zinc sheets was reduced ¼c. on Dec. 9, and is now $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business is improving and prices are a shade higher. For No. 1 ingots, New York delivery, 18¾@19c. per pulplb. is quoted.

Antimony—Business has been more active and sales have been larger. The market is firmer, but prices are unchanged. Cookson's is quoted at 7¾c. per lb. and Hallett's at 7⅜@7⅝c.; while 6⅝@6⅞c. is named for Hungarian, Chinese and other outside brands.

Quicksilver—The market remains quiet and prices are a little lower. The New York quotation has been reduced $1, and is now $44 per flask of 75 lb., with the usual advances for small lots. San Francisco, $43.50 for domestic orders and $41 for export. London price is £8 2s. 6d. per flask, with £8 quoted from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 9—The base price paid this week for 60 per cent. zinc ore was $46. The base price paid for 80 per cent. lead ore was $56 per ton.

SHIPMENTS, WEEK ENDED DEC. 9

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	491,900	60,000	401,000
Galena	432,600	.....	.....
Platteville	410,660	110,150	.....
Hazel Green	388,000	.....	.....
Cuba City	174,000	.....	80,000
Mineral Point	167,920	.....	.....
Harker	165,880	.....	.....
Highland	97,900	.....	.....
Rewey	67,000	.....	.....
Linden	.....	50,000	65,020
Shullsburg	.....	87,000	.....
Total	2,395,860	307,150	546,020
Year to date	143,357,739	8,413,115	27,493,260

Shipped during the week to separating plants, 1,413,115 lb. zinc ore.

Joplin, Mo., Dec. 9—The high price of zinc sulphide ore was $50, the contract base $50.80 and the open-market base $43@47 per ton of 60 per cent. zinc. Zinc silicate sold on a base of $25@27 per ton of 40 per cent. zinc. The average price was $45.58 per ton. Lead sold as high as $64.50, though the bulk of the ore sold at $60@63. The average price, all grades of lead ore, was $61.44 per ton.

The value of the week's shipment was exceeded by but one week of the year. Higher prices make the difference, as the shipment, in tons, is less than many preceding weeks. Compared with the previous week the shipment is 1200 tons of zinc, 21 tons of lead and in value $58,229 increase. Several large purchases of last week were partially loaded out this week, the greater portion of the shipments being advance purchases. Buying was light this week, with reduced price offerings that portend a lowering market. Sellers want to cash their ore before the end of the year, and buyers are generally well supplied with ore. This, with a reserve stock, is favorable to the buyer.

SHIPMENTS, WEEK ENDED DEC. 9

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,345,090	.....	996,660	$109,503
Joplin	2,021,090	.....	208,800	54,980
Jackson	1,079,750	.....	85,990	27,455
Galena	871,140	.....	179,660	25,945
Alba-Neck	885,700	.....	.....	20,056
Duenweg	791,340	64,400	.....	19,561
Cave Springs	670,290	.....	13,030	17,140
Oronogo	470,410	.....	61,750	12,112
Granby	356,480	283,620	32,830	10,940
Miami	389,480	.....	88,000	10,510
Carl Junction	284,190	.....	.....	7,246
Lawton	131,980	.....	.....	3,035
Spurgeon	60,610	60,420	12,210	2,646
Badger	54,890	.....	15,450	1,770
Aurora	56,330	.....	.....	1,350
Saginaw	.....	39,340	10,210	895
Quapaw	.....	11,590	10,030	470
Totals	11,468,770	459,370	1,714,620	$325,614
49 weeks	472,501,920	33,971,320	85,347,550	$12,566,802

Blende val., the week, $265,742; 49 weeks, $9,617,376
Calamine, the week, 7,186; 49 weeks, 518,263
Lead value, the week, 52,686; 49 weeks, $2,432,163

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September	43.45	42.63	39.96	41.29	54.73	59.33
October	43.31	42.38	40.50	40.89	53.18	54.72
November	47.20	45.40	43.20	43.25	54.80	57.19
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, Dec. 13—The general markets continue rather quiet, with moderate business.

Copper Sulphate—The market is quiet but steady, and prices are unchanged. Quotations are $4.50 per 100 lb. for carload lots and $4.75 per 100 lb. for smaller parcels.

Arsenic—Business remains good and the market is firm. Quotations are a shade higher, and nothing has been done under $2.50 per 100 lb. for white arsenic.

Nitrate of Soda—Business in this article is steady. Sales have been good at last prices, 2.20c. per lb. for spot and 2.22½c. for deliveries next year.

Petroleum

Production of petroleum in the Baku district in Russia, nine months ended Sept. 30, was 320,800,000 poods, or 5,252,458 metric tons. This is a decrease of 33,900,000 poods, or 555,045 tons, from last year.

During November, 393 new oil wells were completed in Kansas and Oklahoma; and 55 in Louisiana and Texas.

MINING·STOCKS $

New York, Dec. 13—The general stock market, after a period of quiet and of small fluctuations, showed toward the close increased sales and general advances. United States Steel sold rather heavily at an advance. Amalgamated Copper also made some improvement. Of the other coppers listed on the Exchange, Ray Consolidated sold freely at a fractional gain, and Tennessee Copper also gained on moderate trading.

On the Curb business in mining stocks was on a larger scale than last week. The copper stocks were generally active and there were good sales of Giroux, Greene-Cananea and Inspiration at small advances. Ray Central, however, declined a fraction. The Cobalt stocks were active, La Rose leading, with a higher quotation, but Nipissing lost a fraction. Porcupine Northern sold rather largely. Tonopah Extension held its price unchanged, with good sales. Other mining stocks were rather quiet.

Boston, Dec. 12—Although the copper-share market maintains a good tone it does not respond to the continued advancing tendency displayed in the metal market. Advances in share prices are met with long stocks and the activity is only in spots. As yet, the public is somewhat skeptical relative to the lasting power of the present strength of the metal, although a great many believe that the new year will see stock-market prices more in accord with surrounding conditions.

Hancock broke $6.50 to $23.50 in anticipation of an assessment, but upon the levying of a $2 rate, the price recovered to $26.50. North Butte has been the most active issue during the week, with a low at $23, and the high $25.62½. Live Oak rose $4.87½ to $36, and Inspiration came within a fraction of $10. Nothing more definite relative to the consolidation of these two and Miami has been announced up to date.

Old Dominion responded to an extra dividend by a $3.25 advance to $47.87½. Arizona Commercial is back to around its low price of 25c. Deposits of stock under the reorganization total 107,957 shares and over 95,000 shares paid the first installment of the assessment due Dec. 11.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Sept.	October	Nov.
Alaska shipments	2,807,240	.....	.....
Anaconda	21,565,800	21,400,000	20,850,000
Arizona, Ltd	2,544,000	2,720,000	2,596,000
Balaklala	.....	.....	.....
Copper Queen	6,546,540	7,786,218	6,946,775
Calumet & Ariz	4,198,000	4,784,000	4,390,000
Detroit	1,864,050	2,086,624	1,941,498
East Butte	1,134,000	920,000	1,025,000
Mammoth	1,751,327	1,865,840	.....
Nevada Con	5,328,983	5,547,931	.....
Old Dominion	2,032,000	2,050,000	2,082,000
Shannon	1,550,080	1,124,000	.....
South Utah	266,000	326,578	361,681
United Verde*	2,750,000	2,750,000	.....
Utah Copper Co	9,285,381	8,660,729	.....
Lake Superior*	18,500,000	18,440,000	18,600,000
Non-rep. mines*	14,748,673	15,634,000	.....
Total production	96,872,674	.....	.....
Imports, bars, etc.	26,679,736	22,960,027	.....
Total blister	123,552,410	.....	.....
Imp. in ore & matte	6,408,799	4,137,431	.....
Total	129,961,209	.....	.....
Brit. Col. Cos.:			
British Col. Copper	875,023	778,586	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo	2,094,400	1,245,440	.....
Cananea	.....	5,804,000	.....
Moctezuma	2,112,683	1,719,643	1,682,768
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Spassky, Russia	759,360	.....	.....
Exports from:			
Chile	4,816,000	4,816,000	4,704,000
Australia	6,496,000	7,056,000	7,168,000

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export
XI, 1910	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,051,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,936,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,367	60,084,349
XI	111,876,601	68,039,776	67,049,279

	Visible Stocks.		
	United States.	Europe.	Total.
XII, 1910	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Curb trading has been quiet, but the tone has been generally firm. Rhode Island Coal has benefited by the advent of Harry Payne Whitney into the management. Houghton Copper is up to $5 on reports of favorable developments at the property.

Assessments

Company	Delinq	Sale	Amt
Arizona Commercial, Ariz.	Dec. 11	.....	$1.00
Belcher, Nev	Jan. 3	Jan. 24	0.10
Best & Belcher, Nev	Dec. 6	Dec. 29	0.05
Caledonia, Nev	Dec. 11	Jan. 2	0.10
Challar, Nev	Jan. 3	Jan. 26	0.10
Con. Virginia, Nev	Dec. 16	Jan. 6	0.25
Corbin Copper, Mont	Dec. 11	.....	1.00
Giant, Nev	Nov. 15	Dec. 15	0.006
Hancock Con., Mich	Jan. 10	.....	1.00
Julia, Nev	Dec. 28	Jan. 16	0.05
Kentuck Con., Nev	Jan. 9	Jan. 26	0.05
Ojibway, Mich	Jan. 10	.....	1.00
Overman, Nev	Dec. 13	Jan. 3	0.05
Rainbow, Utah	Dec. 1	Dec. 20	0.002½
Raven, Mont	Feb. 1	.....	0.10
San Antonia, Mex	Nov. 20	.....	0.50
Scorpion, Nev	Dec. 12	Jan. 3	0.02
Smuggler, Utah	Jan. 10	Jan. 10	0.002½
Southwestern Miami, Ariz.	Jan. 15	.....	1.00
Sparrow Hill, Cal	Dec. 16	Jan. 8	.0008½
Superior & Boston, Ariz	Oct. 16	.....	0.50
Swansea, Utah	Nov. 13	.....	0.01
Union Con., Nev	Nov. 27	Dec. 19	0.15
Utah Con. M. & M., Utah	Dec. 20	.....	0.002½
Utah Con. Tintic, Utah	Dec. 7	.....	0.01
Victoria, Mich	Aug. 21	.....	1.00
Winona, Mich	Nov. 10	.....	1.00
Wyandot, Mich	Dec. 14	.....	1.00

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52.171	23.588	24.428	24.082
September	51.440	53.295	52.440	23.743	24.567	24.209
October	50.923	55.490	53.340	23.502	25.596	24.594
November	50.703	55.635	55.719	23.351	25.680	25.649
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12.405	12.715	12.634	55.733	56.264
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.176
November	12.742	12.616	12.914	12.769	57.634	57.253
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.463	40.157	September	34.982	39.755
April	32.976	42.185	October	36.190	41.185
May	33.125	43.115	November	36.547	43.125
June	32.769	44.606	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Mohth	New York		St. Louis		London	
	1910.	1911	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13 009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.260
September	4.400	4.485	4.289	4.356	12.582	14.744
October	4.400	4.265	4.271	4.139	13.091	15.332
November	4.442	4.298	4.314	4.181	13.217	15.821
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5.953	5.129	5.803	22.800	26 801
September	5.514	5 869	5.364	5.719	23.165	27.750
October	5.628	6.102	5.478	5.951	23.900	27.256
November	5.976	6.380	5.826	6.223	24.083	26.795
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23 050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15.84	14.92	14.26	13.30	14.78	14.25
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS Dec. 12

Name of Comp.	Bid.
Acacia	.04½
Cripple Cr'k Con.	.02½
C. K. & N.	.11
Doctor Jack Pot.	.06
Elkton Con.	.68
El Paso	.66
Findlay	.04
Gold Dollar	.17
Gold Sovereign	.02½
Isabella	.13½
Jack Pot	.06
Jennie Sample	.06
Lexington	‡.01
Moon Anchor	.01½
Old Gold	.03½
Mary McKinney	.45
Pharmacist	.02½
Portland	.88
Vindicator	.68
Work	.02½

SALT LAKE Dec. 12

Name of Comp.	Bid.
Beck Tunnel	.16½
Black Jack	.10
Carisa	‡.17
Cedar Talisman	.02½
Colorado Mining	.29½
Columbus Con	‡.10
Daly Judge	‡4.12½
Grand Central	.64
Iron Blossom	.99
Little Bell	‡.35
Lower Mammoth	‡.02½
Mason Valley	10.75
May Day	‡.11
Nevada Hills	2.35
New York	‡.05½
Prince Con	.82
Silver King Coal'n	1.40
Sioux Con	.12
Uncle Sam	.22
Yankee	‡ 13

TORONTO Dec. 12

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.00	Pearl Lake	.41
Hudson Bay	80.00	Porcu. Gold	.56½
Temiskaming	.28¼	Porcu. Tisdale	.03
Wettlaufer-Lor	.84	Preston E. D.	.14½
Apex	.09	West Dome	.70
Central	3.30	Standard	.13
Dobie	‡.90	Foley O'Brien	.52
Dome Exten	.64	Rea	3.10
Hollinger	12.30	Crown Chartered	.52½
Imperial	.06½	Swastika	.25

SAN FRANCISCO Dec. 12

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.02	Belmont	8.22½
Belcher	.37	Jim Butler	.30
Best & Belcher	.17	MacNamara	.27
Caledonia	1.07½	Midway	.23
Challenge Con	.17	Mont.-Tonopah	.73
Chollar	.07	North Star	.25
Confidence	.55	West End Con	.79
Con. Virginia	.80	Atlanta	.17
Crown Point	.55	Booth	.06
Gould & Curry	.08	C.O.D. Con	.13
Hale & Norcross	.15	Comb. Frac	.16
Mexican	4.15	Jumbo Extension	.22
Occidental	.50	Pitts.-Silver Peak	1.22½
Ophir	1.77½	Silver Pick	.07
Overman	.90	St. Ives	.30
Potosi	.10	Tramps Con	.01
Savage	.35	Argonaut	‡3.40
Sierra Nevada	.38	Bunker Hill	‡3.00
Union Con	1.37½	Cent. Eureka	.40
Yellow Jacket	.54	So. Eureka	‡6.00

N. Y. EXCH. Dec. 12

Name of Comp.	Clg.
Amalgamated	63⅛
Am. Agri. Chem	55¾
Am.Sm.&Ref.,com	72⅝
Am. Sm.& Ref., pf.	103¾
Am. Sm. Sec., pf. B	84¾
Anaconda	39
Batopilas Min	1¾
BethlehemSteelpf	58¼
Chino	23
Federal M.& S., pf.	39⅞
Goldfield Con	5
Great Nor., ore ctf.	35½
Homestake	85
Miami Copper	22¾
Nat'nalLead,com.	49⅞
National Lead, pf.	104½
Nev. Consol	18¼
Pittsburg Coal, pf.	82¼
Ray Con	15⅞
RepublicI&S,com	23⅞
Republic I & S, pf.	83¾
SlossSheffi'd,com.	40
Sloss Sheffield, pf.	110
Tennessee Copper	37
Utah Copper	51¼
U. S. Steel, com	64½
U. S. Steel, pf.	109½
Va. Car. Chem	53½

N. Y. CURB Dec. 12

Name of Comp.	Clg.
Barnes King	‡1¼
Beaver Con	.37
Braden Copper	5⅛
B. C. Copper	4½
Buffalo Mines	1.40
Butte & Vipond	.53
Butte Coalition	.18
Cobalt Central	.01
Con. Ariz. Sm.	⅜
Davis-Daly	⅛
Diam'field-Daisy	14
Ely Con	⅜
Florence	.62
Giroux	4
Gold Hill Con	⅛
Greene Cananea	7¾
Greenwater	.06
Guggen. Exp	180
Inspiration	10
Internat. S. & R.	‡124
Kerr Lake	2⅜
La Rose	3⅞
McKinley-Dar-Sa.	1⅜
Min. Co. of A. new	4
Nev. Utah M. & S.	-
Nipissing Mines	7¼
Ohio Copper	1
Pacific Sm. & M.	1/32
Porcupine T'nsite	.51
Precious Metals	‡13/16
Ray Central	1⅞
Red Warrior	‡1⅛
South Utah M. & S.	1/16
Standard Oil (Old)	625
Stand'd Oil of N.J.	340
Stand'd Oil Subs.	325
Stewart	‡.69
Tonopah	7
Tonopah Ex	1⅞
Tri-Bullion	3/32
Tularosa	7/16
Yukon Gold	3/16

LONDON Dec. 13

Name of Com.	Clg.
Camp Bird	£1 10s 3d
Dolores	1 10 0
El Oro	1 3 0
Esperanza	1 7 0
Mexico Mines	7 11 3
Oroville	0 4 6
Ttratton'sInd.	0 2 0
Somboy	1 3 9

BOSTON EXCH. Dec. 12

Name of Comp.	Clg.
Adventure	4¼
Algomah	3¾
Allouez	35
Am. Zinc	24¾
Arizona Com	¾
Bonanza	.36
Boston & Corbin	7¼
Butte & Balak	3¾
Calumet & Ariz	58
Calumet & Hecla	405
Centennial	12¼
Con. Mercur	.03
Copper Range	51¾
Daly-West	5⅝
East Butte	12¼
Franklin	9½
Granby	31
Hancock	26½
Hedley Gold	16⅞
Helvetia	1
Indiana	11¾
Island Cr'k, com.	42¼
Isle Royale	20¾
Keweenaw	.78
Lake	35½
La Salle	5½
Live Oak	34½
Mass	7¼
Michigan	2
Mohawk	47
New Arcadian	3½
New Idria Quick.	7⅞
North Butte	25⅛
North Lake	6½
Ojibway	4½
Old Dominion	47
Osceola	101
Parrot	11
Quincy	66
Shannon	9¾
Shattuck-Ariz	19⅛
Superior	28
Superior & Bost.	3⅞
Tamarack	26⅞
Trinity	4¾
Tuolumne	3⅝
U. S. Smelting	35
U. S. Smelt'g, pf.	48
Utah Apex	2
Utah Con	16⅛
Victoria	2⅛
Winona	5
Wolverine	88
Wyandot	45

BOSTON CURB Dec. 12

Name of Comp.	Last
Ahmeek	210
Bingham Mines	1½
Boston Ely	.85
Boswyocolo	.10½
Cactus	.22
Calaveras	.90
Chief Cons	.52
Corbin	2⅛
Cortez	1⅞
Crown Reserve	2½
First Nat. Cop.	1⅛
Majestic	.37
Mazatan	½
Moneta Porc.	.09
Nat'l Mine & Ex.	.10
Nevada-Douglas	2½
New Baltic	4½
Oneco	1½
Raven Copper	.20
Rhode Island Coal	1½
San Antonio	‡3½
South Lake	5½
Trethewey	.60
Union Mines	‡½
United Verde Ext.	.84
Vulture	5½

‡Last quotation.